A

COMPLETE SYSTEM

OF

PRACTICAL ARITHMETIC,

FOR THE

USE OF SCHOOLS IN BRITISH AMERICA;

TO WHICH ARE ADDED

A SET OF BOOK-KEEPING BY SINGLE ENTRY,

AND A PRACTICAL ILLUSTRATION OF MENTAL ARITHMETIC,
FEDERAL MONEY, RECEIPTS, INLAND AND FOREIGN
BILLS OF EXCHANGE, MENSURATION, ETC.

*The whole adapted to the business of real life, to the circumstances
of the country, and to the present improved state of commerce.*

SECOND EDITION, CORRECTED AND IMPROVED.

By G. & J. GOUINLOCK,

Formerly British Teachers of long experience and extensive practice; Authors
of a Key to this Arithmetic, a System of General Geography, &c.

TORONTO:

Notices of Gouinlock's Geography.

"This System of General Geography is adapted to the interroga-
tive mode of tuition, embracing also the outlines of an elementary
course. Scripture Geography, an introduction to Astronomy, and
problems on maps and the globes. It also contains what has here-
tofore been a desideratum in all our geographies, about eight pages
on British America, and appears altogether a very creditable pub-
lication, both to the authors and to the publishers."—*Examiner.*

"The plan of this very useful work is admirably suitable to the
purpose for which it is designed, and the execution appears highly
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the chief statistical features of every country on the globe."—*Toronto
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The Press throughout the province speaks in very laudatory terms
regarding this useful publication. We wish it an extensive sale,
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"A compilation very well adapted for the use of our provincial
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ciously introduced into it."—*British Canadian.*

Extract of a Letter from the Rev. R. H. Thornton, Superinten-
dent of Education for the Township of Whitby, to Mr. Scobie:

"I have carefully examined G. & J. Gouinlock's Geography,
lately published by you, and am happy to find it a valuable com-
pendium of geography, both because of the information it contains
and of its adaptation to the common schools of the province. The
arrangement of the work is good, and such as, with the exercises,
will almost of necessity lead a teacher, of even small experience, to
adopt a tolerably correct method of teaching its contents.

"The mode adopted by the compilers, to give assistance towards
a correct pronunciation of the proper names, is simple, and will be
highly valued by many whose opportunities of acquiring accuracy
in their pronunciation have been limited.

"The value of the work, as a text book for schools, is, I con-
ceive, greatly enhanced by the Outline of Scripture Geography.
Something of the kind is essential wherever the Scriptures are
employed as a reading book ; and this work supplies what I have
heard many wish to obtain, as an aid to their general perusal of the
sacred volume."—September 24th, 1845.

Notices of Gouinlock's Geography.

"This little work embraces a great deal of useful information for schools, and we take the opportunity of recommending it to the notice of school commissioners and teachers.—*Kingston Chronicle & Gazette.*

Extract of a Letter from Mr. P. Thornton, Superintendent of Schools, Hamilton, to Mr. Scobie:

"I have examined the Geography which you have just published, and have no hesitation in saying that, as a *Canadian School Geography,* it is far superior to any that has hitherto been offered to the public. The Scripture Geography is a feature which greatly enhances its value in schools where the sacred scriptures are perused, and ought to be a strong recommendation in its favour."— 23rd October, 1845.

"This work, of which we highly approve, certainly contains a great quantity of topographical and statistical information, most useful to all who desire to make the science of geography an object of study. The details regarding the British Possessions on this continent, are very ample, and such as should be in the possession of every well-regulated school in the province." — *Brockville Statesman.*

"This work is obviously the result of a great deal of patient labour and persevering attention; its arrangement is simple, progressive, and compendious. We remark with pleasure that the imparting of the proper pronunciation of names is attended to; and we cordially commend it to the attention of teachers, and this we do the more confidently, as we understand the authors are teachers of long experience and extensive practice themselves, and therefore may be presumed to be competent judges of what is required to facilitate the progress of learners in this or any particular branch of knowledge which may occupy their attention and engage their pens." —*Montreal Gazette.*

"The good opinion formed from the title, is not disappointed on an examination of the work. So great an amount of useful inform ation is not often presented in us small a compass, or more interesting shape. We shall keep it by us as a useful book of reference." —*St. Catharines Journal.*

"It is admirably adapted for the use of British American schools; the design of the work is excellent, and most ably has the design been carried out by the authors, who deserve the thanks of the public of the British provinces."— *Woodstock Herald.*

"We have much pleasure in stating that Messrs. G. & J. Gouinlock, who were so very successful in the completion of one of the best arithmetics extant, are in this instance also entitled to the gratitude of the Canadian public, for such an excellent manual of

geography as the one before us, which we consider to be a deside-
ratum in our provincial schools."—*Brantford Courier.*

We have been favoured with a copy of this excellent work, by
the publisher, Mr. Scobie of Toronto, which for its comprehensive
information and judicious arrangement, is perhaps unequalled; and
shows an originality of design not before attempted on this continent,
but which the authors seem to have conceived with judgment and
maturely and satisfactorily accomplished."—*London Times.*

Notices of the 1st Edition of Gouinlock's Arithmetic.

" A work which we make no doubt will have an extensive circu-
lation throughout the Colonies. It is a pleasing circumstance to
see a work of such merit issuing from the press of Canada."—
Hamilton Gazette.

" Formerly, our fellow subjects were wont to condemn works of
this kind, either because they were too much adapted to the
currency of the Mother Country, or that of the neighbouring
Republic, but in the work before us such a happy union of both is
maintained by the authors as to demand for it the best attention of
the Canadian public."—*London Inquirer.*

"It is truly a practical system, and we think very properly avoids
mixing up the *philosophy* with the *practice* of arithmetic, which
has been too much the custom since Sir John Lesslie published his
celebrated work upon the subject. Speculations which we have
heard the learned professor descant upon to his advanced classes
at the University, we think he would have joined us in deeming
unfit for beginners, and merely throwing impediments in their way.
While Messrs. Gouinlock have confined themselves to the practice,
their treatise is as comprehensive as any that we have seen, and
well calculated to give the learner a thorough insight into the
science in all its branches. We can confidently recommend it for
the use of schools."—*Conservative.*

" For the arrangement of the system, the gradation from the easy
examples to the more difficult under each rule, and the simple and
intelligible language in which the rules themselves are expressed,
it deserves the highest praise—simplicity and perspicuity being the
characteristic features of every page. In every respect we can
honestly recommend it as a class book, which will not suffer by
comparison with the best school arithmetics in Great Britain, and
it has several advantages over them for Canadian schools."—
British Colonist.

"This is the best system of arithmetic that has ever emanated from the Canadian press, and which every British teacher in this colony should hail as a grand desideratum. If *twenty-seven* years' experience as a public and private teacher should, in any way, make me competent to judge, I pronounce it the best arithmetic in British North America, and think the authors have conferred a boon upon the Canadian public."—*G. Sunley.*

"It contains much information of practical utility, not to be met with in similar publications. The materials are well chosen and judiciously arranged. I consider it a work of much merit, and particularly well adapted to the instruction of pupils designed for commercial pursuits in this province."—*Wm. Jenkins.*

"From the number, variety, and selection of the sums, as well as the much needed introduction of the different kinds of current money, and the whole arrangement of the system, it is my opinion that the authors have conferred a signal benefit upon the community, and merit the approbation and encouragement of teachers and pupils throughout the province."—*Thos. Brown.*

"After a careful examination of G. & J. Gouinlock's Arithmetic, I have the satisfaction of saying that it has, in my view, been executed with ability and success. The definitions and rules are simple, perspicuous, and judicious; and the exercises numerous, suitable, and of practical utility. In treating the Rule of Proportion, great professional skill and discrimination are evinced, by the selection of the only method of stating the questions that is adapted to supersede the intricate Doctrine of Ratios; to solve all exercises in that rule, whether direct or inverse, simple or compound; and to present the analogy, or statement, with mathematical clearness and consistency. The difficult doctrine of Vulgar and Decimal Fractions is explained in a masterly manner; the subject of Exchange includes the currency of this country, and those of the United States; the fundamental and more useful rules of Mensuration are well illustrated and explained; and the part on Book Keeping by Single Entry, contains a set of books of unusual simplicity, adapted to the retail business of this country, and extended through the period of a whole year.—*James Thom.*

☞ A KEY to this Arithmetic has been lately published by G. & J. Gouinlock; in which they have keyed all the longest questions, to enable the teacher readily to detect errors in the pupils' operations: and all the most difficult ones, to assist the private student in their solution, which perhaps he could not otherwise solve without the aid of a master.

PREFACE.

In presenting a second edition of this work to the public, we embrace the opportunity of expressing our grateful sense of the very favorable reception it has met with, and of repeating our primary object in compiling it, viz., to supply the provinces of British America with a good text-book for schools, comprising a full course of arithmetical instruction, adapted to the improved mode of teaching, to real business, the present state of commerce, and the circumstances of this country.

Some works of this kind are defective for want of practice in the art of teaching; some are too puerile and trifling for the use of respectable schools; and others are too large and expensive, from the quantity of demonstrative and theoretical matter contained in them. Of the last referred to, those by Professors Sir John Lesslie, Thomson, and Murray, stand in the first class; and of these works all *teachers*, especially the young and inexperienced, would do well to possess a copy for their own private study and improvement. At the same time, independent of their value and price, we think they are not the best adapted for practical school purposes, but impede rather than facilitate the progress of pupils in general. Remarks and explanations by the teacher *viva voce* make things intelligible and attractive to the pupils, these philosophical disquisitions are repulsive and not understood by them.

Great care has been taken to have this treatise free from those disadvantages; to have the definitions and rules simple, concise, and intelligible; and the exercises numerous, appropriate, and in progressive gradation: hence the pupils are led on step by step from what is easy to what is more difficult, without any thing that has a tendency to perplex or discourage them in their progress. Sufficient and suitable materials, however, are given to excite the pupils to exert their ingenuity, and to exercise their reasoning faculties, in order to comprehend the meaning, reason, and use of the various rules. The articles contained in the appendix, independently of the body of the work, give this book a superiority in value and utility for this country, over British or Irish Arithmetics.

Toronto, January, 1847,

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NUMERATION TABLE.

ROMAN NOTATION.

The Romans expressed numbers by means of the seven following capital letters of the alphabet.

Numbers,	I.	V.	X.	L.	C.	D.	M.
Value,	1.	5.	10.	50.	100.	500.	1000.

And by repeating and combining these, any of the intermediate or higher numbers were denoted as follows:—

Numbers,	II.	III.	IIII.	XX.	CC.	CCC.	MM.
Value,	2.	3.	4.	20.	200.	300.	2000.

Also, annexing a letter, or letters, of a lower value to one of a higher, denotes their sum :—

As,	VI.	VIII.	XII.	XV.	XVII.	LXX.	DC.
Value,	6.	8.	12.	15.	17.	70.	600.

And if a letter of a lower value be prefixed to one of a higher, it denotes their difference :—

As,	IV.	IX.	XIX.	XL.	XC.	CD.
Value,	4.	9.	19.	40.	90.	400.

The character for 500 is IƆ, or under an abbreviated form D; its value is doubled, or becomes 1000, by prefixing a C to it, as in CIƆ ; 5000 is denoted by IƆƆ, and 10,000 by CCIƆƆ; and the value becomes increased in a decuple proportion, by the successive addition of pairs of C, on each side of the line I; thus 100,000 is denoted by CCCIƆƆƆ ; 1,000,000 by CCCCIƆƆƆƆ.

Though 6 is usually denoted VI, yet in some inscriptions it is expressed by six lines; V. and L. are never repeated, and X. and C. never more than four times.   By placing a line over these numeral characters, their values are increased one thousand fold; thus I. is 1000, V̄. is 5000, X̄. is 10,000, L̄. 50,000, C̄. 100,000 ; 2000 is usually denoted by CIↃCIↃ, or MM, but sometimes also by IICIↃ, or IIM ; and in the same manner 4000 is sometimes represented by IVCIↃ, and similarly in other cases.

ADDITION AND SUBTRACTION TABLE.

	1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12	13
2	3	4	5	6	7	8	9	10	11	12	13	14
3	4	5	6	7	8	9	10	11	12	13	14	15
4	5	6	7	8	9	10	11	12	13	14	15	16
5	6	7	8	9	10	11	12	13	14	15	16	17
6	7	8	9	10	11	12	13	14	15	16	17	18
7	8	9	10	11	12	13	14	15	16	17	18	19
8	9	10	11	12	13	14	15	16	17	18	19	20
9	10	11	12	13	14	15	16	17	18	19	20	21
10	11	12	13	14	15	16	17	18	19	20	21	22
11	12	13	14	15	16	17	18	19	20	21	22	23
12	13	14	15	16	17	18	19	20	21	22	23	24

MULTIPLICATION AND DIVISION TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

SIGNS OR MARKS OF ABBREVIATION.

$=$ (*equal to*)   denotes *equality;*   thus, 20s. $=$ 1 pound.
$+$ (*plus*)   —— *addition;*   —   7+5=12.
— (*minus*)   —— *subtraction;*   —   8—3=5.
$\times$ (*multiplied by*) —— *multiplication;* —   2×4=8.
$\div$ (*divided by*)   —— *division;*   —   12÷3=4.
  : (*is to*) : : (*as*, or *so is*) are signs used in *proportion*, to denote
an *equality of ratios;* thus 4 : 6 : : 8 : 12 denote that the *ratio*
of 8 to 12 is the same as that of 4 to 6, and is read, 4 is to 6
as 8 is to 12.
    $\sqrt{}$ is the sign of the square root; as $\sqrt{}$ 16 $=$ 4.
    $\sqrt[3]{}$ is the sign of the cube root; as $\sqrt[3]{}$ 125 $=$ 5.
    ¼ represents a *farthing*, or the *quarter* of any thing.
    ½   ——   a *halfpenny*, or the *half* of any thing.
    ¾   ——   *three farthings*, or *three quarters* of any thing.

MONEY.

4 farthings	$=$	1 penny	d.
12 pence	$=$	1 shilling	s.
20 shillings	$=$	1 pound or sovereign	£
5 shillings	$=$	1 crown	
21 shillings	$=$	1 guinea	
6s. 8d.	$=$	1 noble	
10s.	$=$	1 angel	
13s. 4d.	$=$	1 mark ster.	
25s.	$=$	1 jacobus	
27s.	$=$	1 moidore	
36s.	$=$	1 joannes.	

TROY WEIGHT.

24 grains	*gr.* $=$	1 pennyweight	*dwt.*
20 pennyweight	$=$	1 ounce	*oz.*
12 ounces	$=$	1 pound	*lb.*
5760 grains	$=$	1 pound.	

Troy weight is used for weighing gold, silver, and jewels ;—
for making experiments in natural philosophy, and for comparing
the different weights with each other.

APOTHECARIES' WEIGHT.

20 grains	*gr.* $=$	1 scruple	*scr.*
3 scruples	$=$	1 dram	*dr.*
8 drams	$=$	1 ounce	*oz.*
12 ounces	$=$	1 pound.	*lb.*

Apothecaries' weight is the same as Troy, though differently
divided ; it is only used for medical prescriptions.

AVOIRDUPOIS WEIGHT.

16 drams	dr.	=	1 ounce	oz.
16 ounces		=	1 pound	lb.
28 pounds		=	1 quarter	qr.
4 qr. or 112 lb.		=	1 hundred weight	cwt.
20 cwt.		=	1 ton	t.
7000 grains		=	1 pound	
14 pounds		=	1 stone	st.
8 stones		=	1 cwt.	

Avoirdupois weight is used for all purposes except those mentioned under Troy and Apothecaries' weight.

MEASURE OF CAPACITY.

2 pints	pt.	=	1 quart	qt.
4 quarts or 8 pints		=	1 gallon	gal.
2 gallons		=	1 peck	pk.
4 pecks		=	1 bushel	bus.
8 bushels		=	1 quarter	qr.
10 quarters		=	1 last.	
10 gallons		=	1 anker.	
18 gallons		=	1 runlet	
42 gallons		=	1 tierce	
63 gallons		=	1 hogshead	
84 gallons		=	1 puncheon	
126 gallons		=	1 pipe or butt	
252 gallons		=	1 tun.	

The imperial measure of capacity is now used for all liquids and all dry goods not measured by heaped measure. The imperial gallon contains 277.2738 cubic inches.

LINEAL MEASURE.

12 lines	li.	=	1 inch	in.
12 inches		=	1 foot	ft.
3 feet		=	1 yard	yd.
5½ yards		=	1 pole	po.
40 poles		=	1 furlong	fur.
8 furlongs or 1760 yards		=	1 mile	mi.
3 miles		=	1 league	lea.
69⅛ miles		=	1 degree	°
360 degrees		=	the earth's circumference.	

4 inches=1 hand for measuring horses. 6 feet=1 fathom in measuring depths. A chain is 66 feet; and is divided into 100 links, each link 7.92 inches.

HEAPED MEASURE.

2 gallons	= 1 peck	
4 pecks	= 1 bushel	
3 bushels	= 1 sack	*sa.*
12 sacks	= 1 chaldron	*cha.*
351.936 cubic inches	= 1 heaped gallon.	

Heaped measure is used for lime, coals, culm, fish, potatoes, and fruit.

SQUARE MEASURE.

144 square inches	= 1 square foot	
9 square feet	= 1 square yard	
30¼ square yards	= 1 square pole or perch	
40 perches	= 1 rood	*ro.*
4 roods	= 1 acre	*ac.*
640 acres	= 1 square mile.	

36 sq. yards are termed 1 rood of building, and 100 sq. feet are called a square of flooring. 10,000 sq. links=1 sq. chain. 100,000 sq. links, or 10 sq. chains=1 acre.

CUBIC OR SOLID MEASURE.

1728 cubic inches	= 1 cubic foot	*c. f.*
27 cubic feet	= 1 cubic yard	*c. y.*
40 cubic ft. of rough, or 50 cubic ft. of hewn timber	= 1 load or ton.	
42 cubic feet	= 1 ton of shipping.	

CLOTH MEASURE.

2¼ inches	= 1 nail	*na.*
4 nails, or 9 inches	= 1 quarter	*qr.*
3 qrs. or 27 inches	= 1 Flemish ell	
4 qrs. or 36 inches	= 1 yard	*yd.*
5 qrs. or 45 inches	= 1 English ell	
6 qrs. or 54 inches	= 1 French ell.	

YARN MEASURE—COTTON.

54 inches	= 1 thread	*thr.*
80 threads	= 1 skein or rap	*sk.*
7 skeins	= 1 hank	*hk.*
18 hanks	= 1 spindle	*sp.*

YARN MEASURE—LINT OR FLAX.

90 inches	= 1 thread	
120 threads	= 1 cut	*cu.*
2 cuts	= 1 heer	*he.*
6 heers	= 1 hasp	*ha.*
4 hasps	= 1 spindle	*sp.*

TIME.

60 seconds	sec. =	1 minute	mi.
60 minutes	=	1 hour	ho.
24 hours	=	1 day	da.
7 days	=	1 week	we.
4 weeks	=	1 common month.	
13 com. months & 1 day, or 52 weeks & 1 day, or 365 days	} =	1 common year.	
365¼ days	=	1 Julian year.	
366 days	=	1 leap year.	
365 days, 5 hours, 48 minutes, 48 seconds	} =	1 solar year.	

The number of days in the 12 calendar months may be easily remembered from the following lines:

> Thirty days have September,
> April, June, and November;
> All the rest have thirty-one,
> Excepting February alone,
> Which hath but 28 days clear,
> And 29 in each leap year.

Divide any year by 4, and if there be no remainder it is leap year.

MOTION OR ANGULAR MEASURE.

60 seconds	=	1 minute	′
60 minutes	=	1 degree	°.
30 degrees	=	1 sign	s.
12 signs	=	1 circle of the zodiac.	

This table is used in astronomy, navigation, geography, &c.

WOOL WEIGHT.

7 lb. avoirdupois	=	1 clove	cl.
2 cloves or 14 lb.	=	1 stone	st.
2 stones	=	1 tod	td.
6½ tods	=	1 wey	wy.
2 weys	=	1 sack	sk.
12 sacks	=	1 last	la.

HAY AND STRAW WEIGHT.

26 lb. avoirdupois of straw	=	1 truss	tr.
56 lb. " old hay	=	1 truss	
60 lb. " new hay	=	1 truss	
36 trusses	=	1 load	lo.

A load of straw is 11 cwt. 64 lb., a load of old hay is 18 cwt., and a load of new hay 19 cwt. 32 lb.

MISCELLANEOUS ARTICLES.

24 sheets	=	1 quire of paper
20 quires	=	1 ream
10 reams	=	1 bale
12 articles	=	1 dozen
20 articles	=	1 score
12 dozen	=	1 gross
12 gross	=	1 great gross
120 articles	=	1 great hundred
5 dozen skins	=	1 roll of parchment *
10 skins	=	1 dicker of leather
12 dozen hides	=	1 last
18 lb. avoirdupois	=	1 barrel of anchovies
112 lbs.	=	1 barrel of gunpowder
56 lbs.	=	1 firkin of butter
64 lbs.	=	1 firkin of soap
200 lbs.	=	1 barrel of potashes
120 lbs.	=	1 box of candles
112 lbs.	=	1 barrel of raisins
120 lbs.	=	1 faggot of steel
7½ lbs.	=	1 galion of train oil
19½ cwt.	=	1 fodder of lead
500 bricks	=	1 load
272¼ square feet	=	1 rood brick work
500 herrings	=	1 barrel
60 herrings	=	1 keg
100 fish	=	1 quintal
100 acres	=	1 hide of land
140 lb. avoirdupois	=	1 boll meal
280 lb. avoirdupois	=	1 sack flour

1 sheet of paper = 4 pages folio, or = 8 pages quarto, or = 16 octavo, or = 24 duodecimo, or = 48 (24to).

A pile of wood 8 feet long, 4 feet wide, and 4 feet high, makes a *cord*. It ought to contain 128 feet solid or cubic measure.

The 12 calendar months, and the days in each.

1.	January	has 31 days.	7	July	has 31 days.
2.	February	28	8.	August	31
3.	March	31	9.	September	30
4.	April	30	10.	October	31
5.	May	31	11.	November	30
6.	June	30	12.	December	31

ARITHMETIC.

PART I.

ARITHMETIC is the science of numbers; it explains their properties, and the art of computing by them.

All numbers are expressed by the ten following figures: 1, one, or unit; 2, two; 3, three; 4, four; 5, five; 6, six; 7, seven; 8, eight; 9, nine; 0, cipher, or nought.

Number is *one or many*, a unit or collection of units; as 1, 6, 15.

Unit or *unity* is the number one.

A *whole number* consists of one or more units; as 1, 3, 8.

A *Fraction* consists of one or more parts of a unit; as ¼, ⅝.

An *Integer* is a whole number as distinguished from a fraction.

An *even number* can be divided by 2 without a remainder; as 4, 6, 8.

An *odd number* cannot be divided by 2 without a remainder; as 3, 5, 7.

An *abstract number* denotes a number of things generally, without a name; as 2, 7, 16.

A *concrete number* mentions the name; as 2 men, 7 miles, 16 shillings.

A *simple number* is a number of one name or denomination; as pounds, £5.

A *compound number* is a number of different names or denominations; as pounds, shillings and pence; £5 6 3.

A *composite number* is the product of two or more other numbers; as 24, which is the product of 4 and 6; hence 4 and 6 are called the *component parts* of 24.

The fundamental rules of Arithmetic are *Addition, Subtraction, Multiplication,* and *Division*.

NUMERATION

Is the art of reading a number expressed in figures.

Quintillions.	Quadrillions.	Trillions.	Billions.	Millions.	Units.
438,759	274,165	341,789	429,561	752,948	756,342

Sextillions, Septillions, Octillions, Nonillions, follow.

B

Read, or write in words, the following numbers: 48 — 103 — 570 — 2,600 — 3,110 — 4,062 — 25,874 — 90,206 — 74,023 — 615,490 — 308,201 — 4,720,536 — 81,504,900 — 420,607,058 — 14,270,053,409—306,058,400,740—8,052,604,170,683.

NOTATION

Is the art of expressing any given number in figures.

Express in figures the following numbers: seventy-five — one hundred and forty-six — three hundred and two—four hundred and seventy — five thousand eight hundred and twenty-three — six thousand four hundred and ninety — nine thousand and nine—fifty thousand and seventy—one hundred and eighty thousand and twenty-five—six hundred and four thousand nine hundred — three millions eighty thousand and forty—sixty millions four hundred and two thousand and twenty-one — three hundred and forty millions five hundred thousand — fifty thousand two hundred millions sixty thousand five hundred and three—six billions forty thousand nine hundred millions seventy thousand and eighty.

SIMPLE ADDITION

Is the method of finding a number equal to several numbers taken together. The number found is called the *sum* or *amount.*

RULE. Write the given numbers under each other; units under units, tens under tens, &c.; draw a line below them; add up the units column, put down the right hand figure, and carry the rest to the next; continue doing so with each column to the last, under which place the whole sum.

EXAMPLES.

4	25	436	5274	2436	43658
3	41	274	1063	7052	7015
1	36	510	8920	847	74820
6	14	125	4318	5309	475
5	52	603	6205	61	95146
2	63	789	3742	7538	8563
21	231	2737	29522	23243	229677
17	206	2301	24248	20807	186019
21	231	2737	29522	23243	229677

(¹)	(²)	(³)	(⁴)	(⁵)
34	426	4326	63207	574625
52	703	1780	21894	705194
16	180	3408	37050	652307
73	317	9854	45618	168072
48	651	7065	74362	831936
—	——	——	——	——
—	——	——	——	——
—	——	——	——	——

(⁶)	(⁷)	(⁸)	(⁹)	(¹⁰)
37486	43875	63854	54963	48378
71630	76031	35469	87052	31702
85019	14708	70387	15804	67495
46754	51684	69536	93891	85264
20583	85460	94720	26370	58036
98307	67259	52016	74855	75941

(¹¹)	(¹²)	(¹³)	(¹⁴)	(¹⁵)
74958	57428	25876	38204	85616
68174	31072	74054	61093	38094
43643	16945	51720	47182	50718
51596	83604	36209	86340	63260
27435	62750	17481	20475	47907
84269	20857	40318	75264	15381
13702	98310	29634	14571	95249

(¹⁶)	(¹⁷)	(¹⁸)	(¹⁹)	(²⁰)
47384	74156	46835	63816	16378
71605	10943	76018	17052	80741
26192	87405	90802	84708	38072
52410	24870	47186	35640	91408
18039	43269	29573	20938	27890
60945	38052	62704	76183	54374
54256	61738	12345	4724	62581
34371	96321	84934	6375	17483

(21)	(22)	(23)	(24)
43836	74958	54386	738569
58492	38594	7859	7098
75649	93625	40	42
89758	89764	87508	57807
36285	45839	98796	586
64937	74383	372	943750
95476	69658	4865	8374

(25)	(26)	(27)	(28)
38546	85496	74939	3854
74953	54967	783	796
95385	96753	9478	98347
38546	75384	83245	854765
85469	58479	74	73
46932	84796	8697	675938
93274	79654	348	4897
32747	96548	6569	976

1. What is the sum of 634+8050+78+95800+4519+85 +766?

2. What is the sum of 8425 + 170 + 95836 + 47 + 708 + 84392+5654+389 ?

3. What is the sum of 70560+839+561428+74807+84+ 7540625+7276+542 ?

4. What is the sum of 9482 + 39867 + 80 + 48927+854+ 5273+98+7000+80172+19+8467 ?

5. Add together—Twenty-seven thousand eight hundred and forty-nine—thirty-six—eight thousand and nine—twelve thousand nine hundred and sixty-three—five thousand and forty— five hundred and seventy-eight thousand and forty-six — four hundred and sixty—forty thousand eight hundred and seven.

6. Find the sum of — Six millions eight hundred and seven thousand nine hundred and two — fifty thousand and seventeen —ninety-six millions eight hundred and five thousand six hundred — nineteen thousand and four — eight millions six hundred and ninety thousand eight hundred and forty — five hundred and sixty-nine millions fifty-five thousand and sixty-three — four hundred and three thousand seven hundred—four hundred and nine.

7. . A. borrowed from B. at one time $348, at another time $73, at another $157, at another $96 : how much did he borrow in all ?

8. A farmer, in clearing his land, found that he had cut down 846 elm trees, 7,350 maple trees, 578 ash trees, 97 oak trees, 625 birch trees, and 54 beech trees: how many did he cut down in all?

9. A farmer has 14 horses, 19 cows, 36 young cattle, 500 sheep, 21 goats, and 18 pigs: what is the number of his live stock?

10. From the Creation to the departure from Egypt was 2,513 years, from thence to the building of Solomon's temple 487, to the Jewish captivity 398, to Alexander's conquest of Persia 273, to the Christian era 333, to the present year 1846: required the time from the creation?

11. Mary's fortune is £215, Margaret's £174, Eliza's £342, Jane's 269: how much is their brother John's fortune, who has as much as all his four sisters?

12. In the year 1841, the population of London was 1,873,676; of Manchester, 296,183; of Liverpool, 286,487; of Dublin, 282,726; of Glasgow, 274,324; of Birmingham, 190,493; of Edinburgh, 166,450; of Leeds, 152,054; of Bristol, 122,296: required the amount of the whole.

(^{1}) 109932.　(^{2}) 195621.　(^{3}) 8256161.　(^{4}) 200239.
(^{5}) 673210.　(^{6}) 681832535.　(^{7}) 674.　(^{8}) 9550.
(^{9}) 603.　(^{10}) 5850.　(^{11}) 1000.　(^{12}) 3644689.

SIMPLE SUBTRACTION

Is the method of finding the difference between two given numbers. The greater is called the *minuend*, the less the *subtrahend*. The number found is called the *remainder* or difference.

RULE. Write the less number under the greater—units under units, tens under tens, &c. Begin at the units, and take each figure in the subtrahend from the figure above it in the minuend, and set down the remainder; but if any figure in the subtrahend be greater than the figure above it, add ten to the upper, subtract as before, and carry one to the under figure; proceed in the same manner to the end.

EXAMPLES.

Minuend	87493652	From	74385921
Subtrahend	36033531	Take	47849136
Difference	51460121	Diff.	26536785
Proof	87493652	Proof	74385921

(¹)	(²)	(³)
853947689	710948564	74925869
310442552	517290413	28470316

(⁴)	(⁵)	(⁶)
651940851	809431789	43709528
156073474	216438274	38072974

(⁷)	(⁸)	(⁹)
90038593	581302970	809080700
60084608	131207874	62109201

(¹⁰)	(¹¹)	(¹²)
30498132	80003947	51800934
926139	8092	999085

(¹³)	(¹⁴)	(¹⁵)
71324900	71009425	60034156
329603	90478	34157

(¹⁶)	(¹⁷)	(¹⁸)
4000000	63849573	70938265
3999999	6295618	7086368

1. What is the difference between 8390000 and 901239 ?
2. What is the difference between 499679 and 1030547 ?
3. What is the difference between 90188 and 210043 ?
4. How much does 8540317200 exceed 8997485 ?
5. How much does 99999 want of 1000000 ?
6. From 8314050 subtract 748392+58396.
7. From 7000000 take 99999+777777.
8. From 63014+8579 take 14580+6495.
9. From 7403612+9483 take 2498758.
10. Subtract 12345678 from 100000000.
11. A man born in 1715, died in 1798 : what was his age ?
12. A man was 98 years old in 1833 : when was he born?
13. America was discovered in 1492 : how long it it since?
14. Gunpowder was invented in 1400 : how long is it since ?

15. A. borrowed from B. $1000, of which he has since paid $419: how much remains unpaid?

16. D. borrowed £150, but paid £75 of it at one time, and £38 at another: how much remains unpaid?

SIMPLE MULTIPLICATION

Is a short method of performing addition; the number to be multiplied is called the *multiplicand;* the number multiplied by is called the *multiplier;* the result is called the *product.* The multiplier and multiplicand are sometimes called *factors.*

RULE I. When the multiplier does not exceed 12, begin at the units place and multiply each figure of the multiplicand by the multiplier, carrying by tens as in addition.

EXAMPLES.

74935862	48529763	84952765
2	3	4
149871724	145589289	339811060

Multiplicand	785649	Multiply	874956
Multiplier	5	By	6
Product	3928245	Product	5249736

Multiply 837429156 by 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.
Multiply 837429156 by 3, 2, 5, 4, 8, 7, 6, 12, 11, 9, 10.

1. 74963854 × 60.		4. 72954386 × 400.
2. 53689472 × 80.		5. 38396857 × 7000.
3. 4854293 × 500.		6. 95827694 × 90000.

RULE II. When the multiplier is greater than 12, but a composite number; multiply by its component parts.

Mult. 74867384 by 14	Mult. 49526378 by 24
2	4
149734768	198105512
7	6
1048143376	Product 1188633072

1.   748391576 × 18 = 13471048368
2.   563427905 × 32 = 18029692960
3.   479360587 × 36 = 17256981132

4.	394857324	$\times$	42	=	16584007608.
5.	684937246	$\times$	48	=	32876987808.
6.	751385794	$\times$	54	=	40574832876.
7.	429536287	$\times$	63	=	27060786081.
8.	570854838	$\times$	72	=	41101548336.
9.	749385627	$\times$	84	=	62948392668.
10.	563728564	$\times$	96	=	54117942144.
11.	748526395	$\times$	108	=	80840850660.
12.	351965748	$\times$	121	=	42587855508.
13.	648374829	$\times$	132	=	85585477428.
14.	574926385	$\times$	144	=	82789399440.

RULE III.   When the multiplier is not a composite number, or consists of several figures, multiply by each figure separately, taking care to place the first figure of each product directly under the figure you multiply by, then add the products.

Mult. 3210421765 by 235   Mult. 4876948600 by 407500
                235   Proof.   407500   Proof.
———————————————   4   ————————————————   4
  16052108825 1×4 243847430 7×7
   9631265295   4   341386402   4
   6420843530   195077944
———————————————   ————————————————

  754449114775   1987356554500000

1.	74851963	$\times$	43	=	3218634409.
2.	38274539	$\times$	57	=	2181648723.
3.	38056918	$\times$	238	=	9057546484.
4.	91847364	$\times$	905	=	83121864420.
5.	48514967	$\times$	870	=	42208021290.
6.	57493685	$\times$	642	=	36910945770.
7.	7846529	$\times$	4372	=	34305024788.
8.	5319476	$\times$	8006	=	42587724856.
9.	8736582	$\times$	70500	=	615929031000.
10.	4517847	$\times$	394000	=	1780031718000.
11.	6085700	$\times$	90580	=	551242706000.
12.	3916000	$\times$	2700500	=	10575158000000.
13.	8450549	$\times$	15463	=	130670839187.
14.	5195463	$\times$	600080	=	3117693437040.

1.   How many stones, each a foot square, will pave a floor 40 feet long and 32 feet broad?

2.   My income is $29 per week: what is that per annum?

3.   How many letters in a volume of 436 pages, each page 39 lines, and each line 52 lesters?

4. 87 townships are each assessed £37: what is the whole assessment?

5. How many sheaves in a farm containing 3,276 shocks, each 12 sheaves?

6. 96 persons have a legacy divided among them, and the share of each is £354: what was the legacy?

7. How many grains of wheat will fill 987 bushels, when one bushel contains 675,000 grains?

8. If the number of students at the College of Edinburgh be on an average 1,856, and each expend £30 for his maintenance, besides £12 for class-fees and books: how much money is thus circulated in Edinburgh?

9. If the number of newspapers published each week in Great Britain be 578, and of each on an average 1145 copies are sold: how many are sold in a year?

10. If the number of hackney coaches in London be 1,200, and each earns 13 shillings per day: how many shillings will they earn in a year of 365 days?

11. A gentleman gave his daughter a bureau, in which were 12 drawers, each having six divisions, and in each division £134: what was the lady's fortune?

12. How many miles will a man walk in 56 years, supposing him to travel 12 miles per day, and that every year consists of 365 days?

(^{1}) 1280. (^{2}) $1508. (^{3}) 884208. (^{4}) £3219.
(^{5}) 39312. (^{6}) £33984. (^{7}) 666225000. (^{8}) £77952.
(^{9}) 34414120. (^{10}) 5694000.s. (^{11}) £9648. (^{12}) 245280.

SIMPLE DIVISION

Is the method of finding how often one number is contained in another.

The number we divide by is called the *divisor*, the number to be divided the *dividend*, and the result the *quotient*.

RULE I. When the divisor is not greater than 12, divide mentally.

	Dividend.		Dividend.
Divisor.	2)46283274	Divisor.	3)47286492
Quotient.	23141637	Quotient.	15762164
	2		3
Proof.	46283274	Proof.	47286492

  1.   852956150746 ÷ 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.
  2.   573860941258 ÷ 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.
  3.   945172384963 ÷ 4, 3, 8, 2, 9, 6, 5, 7, 12, 11, 10.

RULE II.   When the divisor is a composite number, divide by its component parts.

Note. To find the true remainder, multiply the last remainder by the first divisor, to this add the first remainder.

$$14 \begin{cases} 2)74263849 \div 14 \\ \overline{} \\ 7)37131924\text{---}1 \end{cases} \Big\}_{\tfrac{9}{14}}$$

Quot. 5304560—4

Rem. 4×2+1=9

$$20 \begin{cases} 4)27548634 \div 20 \\ \overline{} \\ 5) \ 6887158\text{---}2 \end{cases} \Big\}_{\tfrac{14}{20}}$$

Quot. 1377431—3

Rem. 3×4+2=14.

   1.   7438952617 ÷ 18 = 413275145 rem. 7.
   2.   8507281935 ÷ 24 = 354470080   15.
   3.   5194637084 ÷ 28 = 185522753
   4.   9305263820 ÷ 35 = 265864680   20.
   5.   6714832156 ÷ 42 = 159876956   4.
   6.   3750984719 ÷ 54 = 69462679   53.
   7.   1938527492 ÷ 63 = 30770277   41.
   8.   5409182561 ÷ 72 = 75127535   41.
   9.   4738509127 ÷ 81 = 58500112   55.
  10.   7294850642 ÷ 84 = 86843460   2.
  11.   3710538274 ÷ 96 = 38651440   34.
  12.   8593250750 ÷ 99 = 86800512   62.
  13.   5148365083 ÷ 108 = 47670047   7.
  14.   6039147815 ÷ 110 = 54901343   85.
  15.   4718052938 ÷ 132 = 35742825   38.
  16.   9403678195 ÷ 144 = 65303320   115.

RULE III.   When the divisor is not a composite number, draw a curve on each side of the dividend, and place the divisor on the left of it. Take the least number of figures on the left of the dividend, that will contain the divisor; find how many times they contain it, and place the number in the quotient on the right of the dividend.

Multiply the divisor by the figure placed in the quotient, subtract the product from the assumed figures, and to the remainder annex the next figure of the dividend. Divide the number thus obtained in the same manner, and so on till all the figures of the dividend are used.

Divisor.   Dividend.   Quot.

7486)487698472(65148   65148 $\frac{544}{7486}$ Ans.
    44916   7486

    38538   391432
    37430   521184

Proof.   260592
  1   11084   456036
7 **X** 6   7486
 1   487698472 Proof.
     35987
     29944

     60432
     59888

Remainder   544

    487698472 Proof.

1.	58396274	÷	31	=	1883750	rem. 24.
2.	60837425	÷	46	=	1322552	33.
3.	27419538	÷	53	=	517349	41.
4.	40381694	÷	67	=	602711	57.
5.	19507431	÷	74	=	263613	69.
6.	34182947	÷	85	=	402152	27.
7.	70546152	÷	97	=	727279	89.
8.	174963081	÷	217	=	806281	104.
9.	410589475	÷	308	=	1333082	219.
10.	764127542	÷	470	=	1625803	132.
11.	519380257	÷	526	=	987414	493.
12.	873154963	÷	691	=	1263610	453.
13.	249375016	÷	705	=	353723	301.
14.	931842790	÷	852	=	1093712	166.
15.	838140819	÷	4081	=	205376	1363.
16.	481093600	÷	5830	=	82520	2000.
17.	743725482	÷	7153	=	103973	6613.
18.	619430528	÷	9007	=	68772	1124.
19.	951653000	÷	8700	=	109385	3500.
20.	765419364	÷	43742	=	17498	21848.
21.	919008500	÷	708000	=	1298	24500.
22.	674851680	÷	81030	=	8328	33840.
23.	752087000	÷	66500	=	11309	38500.
24.	648300000	÷	53080	=	10329	36680.
25.	390542000	÷	427000	=	914	264000.

1. My yearly income is $1,352 : what is that per week ?

2. If a floor 40 feet long require 1,280 stones, each a square foot, to pave it : what is its breadth ?

3. The number of letters in a quarto volume which contained 4,465 in a page, were 3,393,400 : how many pages and sheets were in it ?

4. Great Britain and Ireland contain a population of 26,835,773, and their surface is 122,185 square miles : how many inhabitants is that on an average to the square mile ?

5. France contains a population of 34,140,900, at the rate of 167 to the square mile : how many square miles does France contain ?

6. A multiplier is 789, and product 6,678,885 : required the multiplicand.

7. If the hackney coaches of Edinburgh earn 985,500 shillings a year, at the rate of 15s. each per day : what is the number of coaches ?

8. If a pigeon fly at the rate of 56 miles an hour : what time would it take between Edinburgh and the Cape of Good Hope, a distance of 5,544 miles ?

9. A captain, mate, and 56 men, take a prize worth £40,020 : how much will every one receive, supposing them all to share alike?

10. How many miles is a person living in Toronto carried eastward in an hour, in consequence of the earth's diurnal revolution, supposing it performed in 24 hours, and that the parallel of Toronto is 18,360 ?

(^{1}) $26.   (^{2}) 32.   (^{3}) 760p. or 95s.   (^{4}) 219.   (^{5}) 204436.
(^{6}) 8465.   (^{7}) 180.   (^{8}) 99.   (^{9}) £690.   (^{10}) 765.

SUPPLEMENT TO MULTIPLICATION AND DIVISION.

I. When the multiplier contains a fraction.

RULE. First multiply by the *upper* figure of the fraction, and divide the product by the under figure ; then multiply by the integer, and add the product to the quotient.

Mult. 6487536 by $8\frac{3}{5}$ $8\frac{3}{5}$	Mult. 538267 by $406\frac{5}{8}$ $406\frac{5}{8}$
5)19462608	8)2691335
3892521$\frac{3}{5}$ 51900288	336416$\frac{7}{8}$ 3229602 2153068
55792809$\frac{3}{5}$ Prod.	218872818$\frac{7}{8}$ Prod.

1.	5839086	$\times$	$4\frac{1}{2}$	$=$	$26275887.$
2.	7183673	$\times$	$7\frac{3}{4}$	$=$	$55673465\frac{3}{4}.$
3.	4920527	$\times$	$6\frac{2}{3}$	$=$	$32803513\frac{1}{3}.$
4.	2176493	$\times$	$\frac{5}{8}$	$=$	$1360308\frac{1}{8}.$
5.	8431956	$\times$	$10\frac{4}{7}$	$=$	$89137820\frac{4}{7}.$
6.	3065472	$\times$	$12\frac{1}{10}$	$=$	$37092211\frac{1}{5}.$
7.	4936582	$\times$	$\frac{7}{12}$	$=$	$2879672\frac{5}{6}.$
8.	3405274	$\times$	$50\frac{2}{7}$	$=$	$171236655\frac{3}{7}.$
9.	7580924	$\times$	$614\frac{7}{8}$	$=$	$4661320644\frac{1}{2}.$
10.	4718360	$\times$	$302\frac{1}{6}$	$=$	$1425731113\frac{1}{3}.$
11.	9374250	$\times$	$540\frac{11}{15}$	$=$	$5068969450.$
12.	1852148	$\times$	$800\frac{13}{24}$	$=$	$1482721646\frac{5}{6}.$

II. When the divisor contains a fraction.

RULE. Multiply both the dividend and the divisor by the *under* figure of the fraction, taking in the upper figure to the product of the *divisor*; then divide.

Divide 487654 by $3\frac{1}{3}$ Divide 7458 by $8\frac{5}{6}$

```
3⅓)     487654                 8⅚)     7458
5            5                  6            6 Quot.
        ————                           ————
16 ┌ 2)2438270               53)     44748(844¹⁶⁄₅₃
   │     ———————                      424
   └ 8)1219135                        ———
        ————                          234
       152391⅞ Quot.                  212
                                      ———
                                      228
                                      212
                                      ———
                                      16 Rem.
```

1.	7493135	$\div$	$4\frac{1}{2}$	$=$	$1665152\frac{2}{9}.$
2.	2704526	$\div$	$8\frac{3}{4}$	$=$	$309088\frac{24}{35}.$
3.	8571492	$\div$	$10\frac{2}{3}$	$=$	$803577\frac{7}{8}.$
4.	5149300	$\div$	$\frac{4}{5}$	$=$	$6436625.$
5.	6381753	$\div$	$12\frac{5}{8}$	$=$	$505485\frac{39}{101}.$
6.	1437016	$\div$	$\frac{1}{11}$	$=$	$15807176.$
7.	4913628	$\div$	$34\frac{3}{7}$	$=$	$142719\frac{117}{241}.$
8.	5174095	$\div$	$60\frac{1}{10}$	$=$	$86091\frac{259}{601}.$
9.	7438624	$\div$	$524\frac{3}{4}$	$=$	$14175\frac{1171}{2099}.$
10.	3751385	$\div$	$800\frac{7}{12}$	$=$	$4685\frac{7825}{9607}.$
11.	8407439	$\div$	$780\frac{1}{15}$	$=$	$10768\frac{7537}{11711}.$
12.	6734063	$\div$	$274\frac{13}{32}$	$=$	$24540\frac{4276}{8781}.$

MISCELLANEOUS EXERCISES IN THE SIMPLE RULES.

1. Lent to A. £30, to B. 48, to C. 120, to D. 209, to E. £44, to F. 1340 : how much have I lent in all? *Ans.* £1,791.

2. A gentleman has $40 per week : how much is that per year? *Ans.* 2,080.

3. Sir Isaac Newton was born in 1642, and died in 1727 : what was his age? *Ans.* 85.

4. A plantation consists of 10,656 trees, planted in 96 rows : how many trees does each row contain? *Ans.* 111.

5. A person whose fortune was £5,000, gave his eldest son £909, his second son £808, and each of his other three sons £625 : how much has he left? *Ans.* £1,408.

6. 7,412 eggs were packed in 34 casks : how many did each cask contain? *Ans.* 218.

7. How many stones, each a foot square, will pave a court measuring 99 feet by 49? *Ans.* 4851.

8. A man born in 1829 : when will he be 68 years of age? *Ans.* 1897.

9. A field contained 32 acres, and produced 1,664 bushels of grain : how much was that per acre? *Ans.* 52 bush.

10. My farm, last year, produced 526 bushels of wheat, 147 bushels of barley, 78 of beans, 100 of pease, 274 of oats : how many bushels had I in all? *Ans.* 1,125.

11. A certain county contains 124,440 acres, and 20,740 inhabitants : how many acres are there to each? *Ans.* 6.

12. What number divided by 27 will have for quotient 1111? *Ans.* 29997.

13. If a man walks every day 2 hours, at 3 miles an hour, how many miles will he walk in a year? *Ans.* 2190.

14. Borrowed from A. sixty-three dollars, from B. twenty-nine, from C. three hundred and forty-eight, and from D. one thousand and four : how much did I borrow in all? *Ans.* $1444.

15. How many days are in the 12 calendar months? *Ans.* 365.

16. What is the difference between twice 5+20, and twice 20+5? *Ans.* 15.

17. Three boys, A. B. and C. won together 97 marbles at play ; now, if the number of marbles B. won be added to the number C. won, they will make 60 ; and, if the number A. won be added to the number B. won, they will make 62 : how many marbles did each boy win separately? *Ans.* A. 37, B. 25, C. 35.

18. Surnames were first authorised to be used in Scotland by a parliament held at Forfar in 1061 : how long is it since? this being 1846.   *Ans.* 785 years.

19. A merchant has 960 pieces of cotton, containing 26¼ yards each : how many yards has he ?   *Ans.* 25680.

20. A gentleman's income is £2000 per year : how much may he spend per day, and save £540 at the year's end?
                                                          Ans. £4.

21. The figures now used in arithmetic were brought into Europe by the Saracens, from Arabia, in 991, and Lord Napier invented logarithms in 1594 : how many years intervened ?
                                                          Ans. 603.

22. What is the difference between six dozen of dozens, and half a dozen of dozens ?   *Ans.* 792.

23. The sun's diameter is 890,000 miles, and the earth's 7970 : required the difference.   *Ans.* 882,030.

24. How many seeds were produced by a bean which had 14 stems, each stem 19 pods, and each pod 6 seeds ?
                                                          Ans. 1596.

25. What is the difference between the area of a floor 50 feet by 34, and the joint areas of two floors, each one half of these dimensions ?   *Ans.* 850 feet.

26. What is the annual number of deaths in the world, supposing its population to be 815,000,000, and that every year one out of 32 dies ?   *Ans.* 25,468,750.

27. A ship bound to a port 860 miles distant, after sailing forward 256 miles, is driven back 58 miles ; she then gets forward 156, and is driven back 180 miles ; again she gets forward 680, and is driven back 56 : how far is she distant from her port ?   *Ans.* 62 miles.

28. How much is one billion greater than 197,840,605 ?
                                              Ans. 999,802,159,395.

29. The sum of £5000 is to be raised from 12 counties, in each county are six townships : how much must each township contribute ?   *Ans.* £69⁴⁄₉.

30. How many pins will a boy point in a week, who works eight hours per day, and points 16,000 pins in an hour?
                                                          Ans. 768,000.

31. The art of printing was discovered in the year 1449 : how long is it since ? this being 1846.   *Ans.* 397 years.

32. How many strokes does the hammer of a clock strike in a day, and how many in a year of 365 days ?
                                      Ans. 156 per day, 56,940 per year.

QUESTIONS FOR EXAMINATION.

What is arithmetic? By what are all numbers expressed? What do you mean by number? What is the meaning of unit or unity? What is a whole number? Of what does a fraction consist? What is meant by an integer? What is an even number? What is an odd number? What is an abstract number? What is a concrete number? What is a simple number? What is a compound number? What is a composite number? What are the fundamental rules of arithmetic? What is meant by Numeration? What do you mean by Notation? What is simple Addition? How should the numbers be placed? What is the number found called? What is simple Subtraction? What is the greater number called? What is the less number called? How do you place the numbers in subtraction? What is simple Multiplication? What is the number to be multiplied called? What is the number you multiply by called? What is the number arising from the operation called? What are the multiplicand and multiplier sometimes called? How do you multiply when the multiplier does not exceed 12? How do you multiply when the multiplier exceeds 12, but is found in the multiplication table? When the multiplier is not in the table, or consists of several figures, how do you proceed? How do you multiply when there is a fraction in the multiplier? What is simple Division? What is the number to be divided called? What is the number you divide by called? What is the result of the operation called? How do you divide when the divisor does not exceed 12? How do you divide when the divisor exceeds 12, but is a composite number? How do you divide when there is a fraction in the divisor?

PART II.

COMPOUND ADDITION

Is the operation of adding two or more numbers of different denominations.

RULE. Write numbers of the same denomination under each other; find the sum of the right hand column, which divide by as many of that name as make one of the next higher; place the remainder, if any, below the column added, and carry the quotient to the next.

Proceed in the same manner with the remaining denominations to the last, which add as abstract numbers.

£	s.	d.		£	s.	d.		£	s.	d.
247	10	11½		410	19	6¾		246	11	6¾
381	17	6¾		794	13	11		371	16	4½
148	12	9½		421	12	7½		713	10	11¾
412	16	7¼		876	17	10¾		465	17	10½
319	11	11¾		768	18	4		654	13	9¾
470	19	9¾		216	16	4¾		892	16	11
1981	9	8½		3489	18	8¾		3345	7	6¼
1733	18	9		3078	19	2		3098	15	11½
1981	9	8½		3489	18	8¾		3345	7	6¼

(1)				(2)				(3)				(4)		
£	s.	d.		£	s.	d.		£	s.	d.		£	s.	d.
74	16	9½		54	17	8¾		17	13	6¼		43	14	11½
45	8	6¾		67	12	10		80	19	7½		96	17	6¼
32	15	7¼		54	18	7½		56	8	10		57	16	7¾
19	17	8		19	9	6¼		63	15	8¾		75	13	5½
83	9	10½		95	10	4		49	7	3		58	19	10¼
67	14	5¼		47	18	11½		95	14	9½		84	15	8¾

(5)				(6)				(7)				(9)		
33	17	6¾		34	12	7¾		81	16	7¾		14	12	4½
50	6	11		8	17	8¼		37	14	6½		75	8	11
43	18	5¼		95	6	11		70	15	9¼		9	15	8¼
79	15	8¼		7	14	6½		48	17	8½		63	7	5
94	9	10		80	10	4¾		54	13	4¼		8	16	7¾
25	13	4½		6	9	10		45	17	3½		81	9	10
76	12	8¾		74	15	3¼		63	12	9¾		9	13	6½

(9)				(10)				(11)				(12)		
347	16	8½		584	17	6¼		473	15	10		160	15	8¾
763	14	6¼		419	15	7½		516	8	7½		905	11	2¼
518	15	7¾		372	8	11		190	14	6¼		384	7	9½
490	10	3		106	14	3¾		740	17	8½		841	16	4
206	18	5½		890	16	8½		305	9	4¾		426	8	7½
641	13	9		247	9	4½		864	18	11½		273	10	3¼
173	17	4¼		671	11	10		252	6	9		739	14	11

c

(13) £	s.	d.	(14) £	s.	d.	(15) £	s.	d.	(16) £	s.	d.
758	15	4½	426	10	3½	547	13	6	748	15	8¼
190	13	9¾	581	16	4¼	670	14	8½	169	10	7½
614	17	6¼	103	10	10	418	10	7¼	848	18	4¼
423	18	3½	874	15	7¾	385	18	4¾	520	17	9½
271	11	5¾	240	17	3	836	13	5½	473	14	5½
542	14	8½	718	13	6½	203	19	2	968	19	3½
305	13	2½	361	14	6¼	784	14	9¼	255	10	10¼
824	16	1¾	718	18	11	351	17	4½	847	18	8¾

(17) £	s.	d.	(18) £	s.	d.	(19) £	s.	d.	(20) £	s.	d.
749	14	8½	374	14	3¾	748	13	7¼	304	16	7¼
420	17	5¾	857	16	8½	409	7	10	82	5	4
368	10	7¼	260	17	11	83	14	6¾	740	12	8¾
573	18	4	538	13	7½	950	8	11	16	8	5
149	15	3¾	741	8	10½	16	19	2½	853	17	3½
954	17	10¼	479	15	4¾	862	6	5	74	6	10
507	13	9½	152	19	6¼	45	10	8½	523	10	7½
475	19	4½	604	7	6	531	5	4	65	9	6

(21) £	s.	d.	(22) £	s.	d.	(23) £	s.	d.
4385	16	7	347	14	8	74931	12	4
504	10	8½	7802	8	5¼	180	7	6½
86470	8	3	90	15	7½	19	14	11
79	15	10	18417	6	3¾	38574	6	5¼
95314	6	5¾	281	17	10	3150	17	9
851	17	9	65164	9	4½	406	5	8¾
24	3	4¼	58	13	6¼	48385	12	3
74300	18	6	7630	8	1¾	20	10	7½
162	5	11½	25	14	11	4817	4	10

1. What is the sum of £43 17s. 4½d., £817 6s. 10¼d., £6 12s. 0¾d., £510 8s. 6d., £73 17s. 5½d., £18 10s. 11¾d., £425 18s. 7½d.?   *Ans.* £1896 11s. 10¼d.

2. What is the sum of £516 14s. 10¼d., £90 8s. 5¾d., £8 7s. 3d., £3710 5s. 6d., £436 0s. 10½d., £15 19s. 4d., £7 6s. 6½d.?   *Ans.* £4785 2s. 10d.

3. Add £4 13s. 6d., £73 9s. 11½d., £7 18s., 15s. 6¾d., £46 9s. 11¼d., £5 11s. 0½d., £20 10s., £8 19s. 7¼d.   *Ans.* £168 7s. 7¼d.

4. Add £436 15s. 8½d., £75 7s. 10d., £4 0s. 6¾d., £1630 12s., £45 17s. 0¼d., £500, £68 14s. 3¼d., £5 8s. 10d.
Ans. 2766 16s. 3d.

5. Find the sum of £90 12s. 6¼d., £8 19s. 11¾d., £67 8s. 4d., £26 16s. 10¾d., £9 12s. 8¼d., £63 13s. 11d., £8 8s. 9d., £81 12s. 6½d. *Ans.* £357 5s. 7¼d.

6. What do these three sums of money amount to—the first is £11 19s. 6d., the second is 21 guineas, the third is 3 half-guineas and a crown? *Ans.* £35 17s.

7. A servant went to market and laid out on tea £1 14s. 8½d., on coffee 18s. 6d., on sugar £2 0s. 6d., on beef 27s., on mutton 36s., on veal 9s. 3½d, on various other articles 25s.: how much did he lay out in all? *Ans.* £9 11s.

8. A man lent his friend at different times these several sums, viz., £25 15s., £8 7s. 6d., £36 14s. 10d., and four score and nineteen pounds, half a guinea, and a shilling: how much did he lend in all? *Ans.* £170 8s.

9. Paid for ground to build a house £200, mason's bill £324 17s. 6d., carpenter's £483 8s. 9d., slater's £98 13s 4d., smith's £10 18s. 9d., glazier's £48 7s. 10d.: at what must I sell it to gain £100? *Ans.* 1266 6s. 2d.

10. A clerk, having been sent out for the payment of some bills, received from A. £23 12s. 6d., from B. £31 17s. 10d., from C. £19 18s. 8d., from D. £46 10s. 3d., from E. £17 13s. 9d., and from F. £15 5s.: how much did he receive in all?
Ans. £155 8s.

COMPOUND SUBTRACTION

Is the method of finding the difference between two compound numbers.

Rule. Write like numbers under one another. Begin at the right hand and subtract each number of the subtrahend from that of the like name in the minuend; but if the under number be greater, subtract it from the value of the next higher name, add the remainder to the upper number, and write the sum below; but in this case carry 1 to the under figure of the next name.

Minuend.	£27	18	11½	From £38	10	4¼	£372	14	6¼
Subtrahend.	19	17	11¾	Take 27	11	11½	178	16	8¾
Difference.	8	0	11¾	Diff. 10	18	4¾	193	17	9½
Proof.	27	18	11½	Proof. 38	10	4¼	372	14	6¼

c 2

(1)			(2)			(3)			(4)		
£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
73	18	4¼	43	8	2½	685	13	0¼	814	19	3
27	5	7½	17	11	9¾	419	15	3½	45	8	6¼

(5)			(6)			(7)			(8)		
85	10	3¼	70	3	0¼	714	6	3	600	10	11½
19	10	10¼	8	14	8¾	190	11	10¾	419	17	4¾

(9)			(10)			(11)			(12)		
90	5	10	53	19	2	631	11	7¼	914	6	3
55	13	1½	17	3	11¾	236	15	8½	615	11	4¼

(13)			(14)			(15)			(16)		
10	0	11	24	19	0	560	0	0	708	0	0
1	15	2¾	9	5	1¼	96	0	4	199	19	0¾

(17)			(18)			(19)			(20)		
94	13	5½	65	14	7½	874	17	8¼	563	17	7¼
28	16	8¾	16	17	9¾	489	18	11½	278	17	8½

(21)			(22)			(23)			(24)		
70	0	0	80	0	0	500	0	0	700	0	0
40	0	1¼	19	19	0¾	90	0	11½	9	19	11¾

(25)			(26)			(27)			(28)		
54	13	6	30	10	5¼	705	17	8½	914	11	8¼
48	14	9½	9	12	10½	418	6	10¾	219	13	8¾

(29)			(30)			(31)			(32)		
82	11	11¼	95	3	10	400	0	0	690	10	0
11	11	11½	5	19	0¾	9	0	0½	99	9	9½

1. What is the difference between £589 15s. 8½d. and £748 13s. 6¼d.?

2. What is the difference between £35 19s. 11¼d. and £35 19s. 2¼d.?

3. From £1 subtract 1s. 1¼d.

4. Borrowed £10, of which I have paid £3 3s. 3¼d.: how much am I still in debt?

5. How much is the sum of £11 11s. 11¾d. less than £12?

6. £1000—£135 15s.+£74 8s. 7½d.+£209 12s. 11¼d.

7. £43 4s. 8¾d.+£78 12s. 4d.—£100 16s. 9½d.+£8 7s. 8¾d.

8. What sum added to £83 13s. 4½d. will make £100?

9. A horse in his harness is worth £30 10s.; out of it, £19 19s. 9d.: what is the value of the harness?

10. I lent a friend £100; and have received from him in cash £43 17s. 6d., in goods £46 2s. 8½d: how much does he owe me?

11. Borrowed from a neighbour at one time £27 16s. 6d., at another time £6 12s.; but I have since paid him twice the amount of the latter sum, and £10 besides: how much do I still owe him?

12. A gentleman's yearly income is £500; his household expenses £294 13s. 7½d., rent £54 13s. 6d., taxes £20 11s. 8½d., servants' wages £25 17s. 11d., tradesmen's accounts £52 11s. 7¾d., and incidental expenses £24 17s. 11¼d.: how much does he save?   *Ans.* £26 13s. 8d.

COMPOUND MULTIPLICATION

Is the operation of multiplying a compound quantity by a simple number.

RULE I. When the multiplier does not exceed 12, place it under the lowest denomination of the multiplicand, then multiply, and carry as in compound addition.

Multiply	£74 .18	7¾	£38 9 5¼	£658 12 10½
By		2	4	7
Ans.	149 17	3½	153 17 9	4610 10 1½

1. Multiply £678 17s. 8½d. by 4, 2, 7, 3, 5, 8, 6, 10, 9, 12, 11.

2. Multiply £945 8s. 7¾d. by 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.

RULE II. When the multiplier is a composite number, multiply by its component parts.

Multiply £8 15 7½ by 24   Multiply £5 8 4¼ by 35
                6   5
                                      ———————————
      52 13 9   27 1 11¼
              4   7
      ———————————   ———————————
     210 5 0 Ans.   189 13 10¼ Ans.

				£	s.	d.		£	s.	d.
1.	14 pair of Gloves	....	@	0	2	9	Ans. 1	18	6
2.	15 yards Nankeen	....	@	0	1	7½	... 1	4	4½
3.	16 Handkerchiefs	....	@	0	7	8	... 6	2	8
4.	18 gallons Wine	....	@	0	14	9	... 13	5	6
5.	20 yards Moleskin	....	@	0	4	9	... 4	15	0
6.	21 quires Paper	....	@	0	1	2½	... 1	5	4½
7.	22 yards Calico	....	@	0	1	3¼	... 1	7	11½
8.	24 pair Boots	....	@	0	13	6	... 16	4	0
9.	25 bushels Oats	....	@	0	1	4¾	... 1	14	10¾
10.	27 ounces Bark	....	@	0	0	5½	... 0	12	4½
11.	28 Quarto Volumes	....	@	1	12	10	... 45	19	4
12.	30 pair Shoes	....	@	0	8	9¼	... 13	3	9
13.	32 bushels Wheat	....	@	0	5	3	... 8	8	0
14.	33 Days' Wages	....	@	0	4	7¼	... 7	11	11¼
15.	35 yards Linen	....	@	0	2	11	... 5	2	1
16.	36 Horses	....	@	14	17	8	... 535	16	0
17.	40 yards Ribbon	....	@	0	0	9¾	... 1	12	6
18.	42 Sheep	....	@	1	2	3	... 46	14	6
19.	44 pair Stockings	....	@	0	3	1½	... 6	17	6
20.	45 yards Silk	....	@	0	5	10	... 13	2	6
21.	48 gallons Brandy	....	@	0	16	7	... 39	16	0
22.	49 lbs. Tobacco	....	@	0	1	5¼	... 3	10	5¼
23.	50 lbs. Sugar	....	@	0	0	8¾	... 1	16	5½
24.	54 Maps	....	@	0	17	6	... 47	5	0
25.	56 cwt. Sugar	....	@	4	13	6	... 261	16	0
26.	60 Norwich Shawls	....	@	0	11	4½	... 34	2	6
27.	63 yards Silk	....	@	0	4	10	... 15	4	6
28.	64 barrels Beer	....	@	1	8	0	... 89	12	0
29.	66 Arithmetics	....	@	0	1	8¾	... 5	14	1½
30.	70 lbs. Tea	....	@	0	4	4¼	... 15	6	3
31.	72 acres Land	....	@	2	17	6	... 207	0	0
32.	77 pair Shoes	....	@	0	9	3¼	... 35	13	10¼
33.	80 quarts Rum	....	@	0	1	11¼	... 7	18	4
34.	84 Hats	....	@	0	18	9	... 78	15	0
35.	88 lbs. Cloves	....	@	0	2	5½	... 10	16	4
36.	90 bottles Wine	....	@	0	2	7¼	... 11	14	4½
37.	96 yards Broad Cloth	......	@	1	5	3	... 121	4	0

		£	s.	d.		£	s.	d.
38.	100 Watches .... @	4	17	8	...	488	6	8
39.	108 Deals .... @	0	1	2¾	...	6	12	9
40.	120 Oxen .... @	9	13	5	.	1160	10	0
41.	110 firkins Butter .... @	2	8	10	...	268	11	8
42.	121 Ewes .... @	0	17	11	...	108	7	11
43.	132 stones Beef .... @	0	3	4½	...	22	5	6
44.	144 dozen Eggs..... .... @	0	0	7¼	...	4	7	0

RULE III. When the multiplier is not a composite number; multiply by the component parts of the number nearest to it, and the multiplicand by what the given number is greater or less, and add or subtract accordingly.

Mult. £2 14 7½ by 38   or thus.

$$
\begin{array}{r}
2 \;\; 14 \;\; 7½ \times 2 \\
6 \\
\hline
16 \;\; 7 \;\; 9 \\
6 \\
\hline
98 \;\; 6 \;\; 6 \\
5 \;\; 9 \;\; 3 \\
\end{array} \Big\} \text{ add}
$$

Ans. 103 15 9

$$
\begin{array}{r}
£2 \;\; 14 \;\; 7½ \times 2 \\
4 \\
\hline
10 \;\; 18 \;\; 6 \\
10 \\
\hline
109 \;\; 5 \;\; 0 \\
5 \;\; 9 \;\; 3 \\
\end{array} \Big\} \text{ subt.}
$$

Ans. 103 15 9

		£	s.	d.		£	s.	d.
1.	17 Books..................... @	0	5	4	Ans	4	10	8
2.	31 yards Cloth .... @	0	10	7½	...	16	9	4½
3.	39 acres Land .... @	2	15	6	...	108	4	6
4.	47 acres Land .... @	0	17	10	...	41	18	2
5.	58 lbs. Sugar .... @	0	0	7½	...	1	16	3
6.	67 Heifers .... @	3	4	0	...	214	8	0
7.	73 cwt. Sugar.......... ... @	2	0	11¼	...	149	8	5¼
8.	78 bottles Wine .... @	0	3	10	...	14	19	0
9.	85 stones Candles .... @	0	7	1½	...	30	5	7½
10.	97 yards Cloth .... @	0	8	9¼	...	42	10	9¼
11.	102 pair Stockings .... @	0	1	9	...	8	18	6
12.	107 Ewes .... @	0	15	0¾	...	80	11	8¼
13.	113 Cows .... @	5	6	3	...	600	6	3
14.	122 lbs. Soap .... @	0	0	3¼	...	1	13	0½
15.	128 Hats .... @	1	0	6	...	131	4	0
16.	134 pair Gloves .... @	0	1	5½	...	9	15	5
17.	140 yards Moleskin........ @	0	3	3¾	...	23	3	9
18.	146 acres Land .... @	3	10	1	...	511	12	2
19.	150 pair Boots .... @	0	17	8	...	132	10	0
20.	153 stones Cheese .... @	0	6	10	...	52	5	6

Note. Multiplication by large numbers can also be performed, but such questions are more easily solved by practice,

563 yards @ 15s. 7d. per yard.　6248 yards @ 3s. 5d. per yard.

```
 £0  15   7 × 3              £0   3   5 × 8
         10                           10
      ─────────                    ─────────
      7 15  10 × 6               1 14   2 × 4
             10                          10
      ─────────                    ─────────
     77 18   4                   17  1   8 × 2
             5                           10
      ─────────                    ─────────
    389 11   8  price of 500.   170 16   8
     46 15   0  price of  60.            6
      2  6   9  price of   3.       ─────────
      ─────────        ────     1025  0   0  price of 6000.
    438 13   5  price of 563.     34  3   4  price of  200.
                                   6 16   8  price of   40.
                                   1  7   4  price of    8.
                                    ─────────
                                1067  7   4  price of 6248.
```

```
     £   s.  d.                      £    s.  d.
     3  16   5   ×    435   =     1662    1   3
    10   7   4½  ×    174   =     1804    3   3
     4  12  10   ×    847   =     3931    9  10
     5   8   3½  ×   3740   =    20250   10  10
     2  15   8   ×   6054   =    16850    6   0
     6  14   9   ×   1507   =    10153    8   3.
```

COMPOUND DIVISION

Is the operation of dividing a compound quantity by a simple number, &c.

RULE I. Divide the highest denomination of the dividend by the divisor, and reduce the remainder, if any, to the next inferior denomination, adding the given number of that name; divide this as before, and proceed in the same manner to the lowest denomination.

Divide £547 13s. 6½d. by 4.　　Divide £5149 13s. 8¾d. by 7.

```
       £   s.   d.                        £   s.   d.
    4)547  13   6½                     7)5149  13   8¾
      ───────────                        ────────────
      136 18   4½—½ Ans.                  735 13   4½—5/7 Ans.
```

Divide £7493 17s. 5½d. by 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.
Divide £91075 8s. 3¾d. by 4, 3, 2, 8, 7, 6, 5, 12, 11, 9, 10.

RULE II. When the divisor is a composite number, divide by its component parts.

	£	s.	d.			£	s.	d.	
1.	375	16	8	÷	25 =	15	0	8	
2.	816	13	7½	÷	36 =	22	13	8½	$\frac{1}{6}$
3.	493	17	6¾	÷	45 =	10	19	6	$\frac{1}{15}$
4.	904	9	3	÷	54 =	16	14	11¾	$\frac{1}{4}$
5.	562	15	8½	÷	60 =	9	7	7	$\frac{17}{30}$
6.	100	7	0	÷	63 =	1	11	10¼	$\frac{1}{7}$
7.	750	10	0	÷	70 =	10	14	5	$\frac{4}{7}$
8.	417	9	8	÷	72 =	5	15	11½	$\frac{4}{9}$
9.	5173	14	7½	÷	77 =	67	3	9¾	$\frac{51}{77}$
10.	4805	8	9	÷	81 =	59	6	6¼	$\frac{1}{3}$
11.	1364	13	6¾	÷	90 =	15	3	3	$\frac{17}{30}$
12.	8550	0	0	÷	99 =	86	7	3¼	$\frac{1}{11}$
13.	3256	18	0	÷	110 =	29	12	1¾	$\frac{47}{55}$
14.	9037	15	8	÷	121 =	74	13	10	$\frac{8}{11}$
15.	7830	0	0	÷	132 =	59	6	4¼	$\frac{5}{11}$
16.	5107	16	0	÷	144 =	35	9	5	

17. If 30 yards of cloth cost £37 15s.: what is the price of 1 yard? *Ans.* £1 5s. 2d.

18. If 36 lbs. tea cost £9 1s. 6d.: what is the price of 1 lb.? *Ans.* 5s. 0½d.

19. If 42 yards linen cost £5 0s. 7½d.: what is the price of 1 yard? *Ans.* 2s. 4¾d.

20. Divide £25 10s. 5d. equally among 50 persons. *Ans.* 10s. 2¼d.

21. Bought 63 yards silk for £17 6s. 6d.: what is that per yard? *Ans.* 5s. 6d.

22. Bought 72 cwt. sugar for £243 18s.: what is that per cwt.? *Ans.* £3 7s. 9d.

23. Sold 84 yards calico for £5 8s. 6d.: how much is that per yard? *Ans.* 1s. 3½d.

24. Sold 96 sheep for £84 16s.: at what was that a piece? *Ans.* 17s. 8d.

25. Sold 100 acres land for £252 10s.: what was that per acre? *Ans.* £2 10s. 6d.

26. What is the price of 1 yard, when 120 cost £21 15s.? *Ans.* 3s. 7½d.

27. What is the value of 1 gallon rum, at £58 6s. for 132 gallons? *Ans.* 8s. 10d.

28. What is the price of sugar per lb., at £4 10s. for 144 lb.? *Ans.* 7½d.

Note. When the divisor is not a composite number, divide as in long division.

Divide £27 13s. 7½d. by 17.   Divide £452 8s. 10¼d. by 74

  £ s. d. £ s. d.   £ s. d. £ s. d.

17)27 13 7½(1 12 6¾ $\frac{3}{17}$ Ans.   74)452 8 10¼(6 2 3¼ $\frac{39}{74}$ Ans

  17   444
_____   _____
  10   8
  20   20
_____   _____
 213   168·
  17   148
_____   _____
  43   20
  34   12
_____   _____
   9   250
  12   222
_____   _____
 115   28
 102   4
_____   _____
  13   113
   4   74
_____   _____
  54   39
  51
_____
   3

	£	s.	d.			£	s.	d.	
1.	743	16	5½	÷	23 =	32	6	9½ $\frac{12}{23}$	
2.	514	13	7¾	÷	37 =	13	18	2¼ $\frac{34}{37}$	
3.	180	6	4	÷	43 =	4	3	10¼ $\frac{29}{43}$	
4.	879	15	6	÷	52 =	16	18	4½	
5.	426	11	3	÷	65 =	6	11	3	
6.	960	9	4½	÷	76 =	12	12	9 $\frac{9}{38}$	
7.	290	14	10	÷	83 =	3	10	0½ $\frac{66}{83}$	
8.	704	12	3¾	÷	97 =	7	5	3¼ $\frac{59}{97}$	
9.	6538	10	9	÷	131 =	49	13	3	
10.	4063	9	11	÷	165 =	24	12	6½ $\frac{26}{165}$	
11.	1952	0	8½	÷	247 =	7	18	0½ $\frac{212}{247}$	
12.	8169	18	4	÷	365 =	22	7	8	
13.	7619	8	0	÷	416 =	18	6	3¾ $\frac{3}{13}$	
14.	5371	16	9	÷	508 =	10	11	5½ $\frac{64}{127}$	
15.	3675	1	3¼	·|·	629 =	5	16	10¼	

	£	s.	d.				£	s.	d.	
16.	8050	9	2	÷	760	=	10	11	10¼	
17.	5913	15	6¾	÷	809	=	7	6	2¼	$\frac{474}{800}$
18.	4184	8	0	÷	951	=	4	8	0	
19.	2700	19	11	÷	1609	=	1	13	6¾	$\frac{357}{1609}$
20.	9067	9	7	÷	3205	=	2	16	7	
21.	6543	15	7½	÷	4070	=	1	12	1¾	$\frac{202}{407}$
22.	1800	0	0	÷	5708	=	0	6	3½	$\frac{1046}{1427}$
23.	7195	7	10	÷	6315	=	1	2	9¼	$\frac{5281}{6315}$
24.	3714	19	0	÷	7000	=	0	10	7¼	$\frac{419}{875}$
25.	2088	4	2	÷	8716	=	0	4	9½	
26.	9154	12	0	÷	12072	=	0	15	2	
27.	6307	15	4½	÷	50300	=	0	2	5¾	$\frac{5129}{25400}$
28.	8128	9	1	÷	83014	=	0	1	11½	

29. What is cloth per yard, when 78 yards cost £92 12s. 6d.?
Ans. £1 3s. 9d.

30. What is wheat per quarter, when 85 quarters cost £225 12s. 6d.? *Ans.* £2 13s. 1d. $\frac{1}{17}$

31. Divide a prize of £2011 9s. equally among 98 sailors.
Ans. £20 10s. 6d.

32. If I spend £70 4s. in 2 years: how much is that per week? *Ans.* 13s. 6d.

33. If you earn £47 2s. 11d. in a year: what is that per day?
Ans. 2s. 7d.

34. Sold 119 gallons beer for £9 18s. 4d.: what was that per gallon? *Ans.* 1s. 8d.

35. My yearly rent is £75: how much is that per week?
Ans. £1 8s. 10d. $\frac{2}{13}$

36. How much must I spend per day, to spend £300 a year? *Ans.* 16s. 5¼d. $\frac{3}{73}$

37. Bought 470 lambs for £180: how much is that a piece?
Ans. 7s. 7¾d. $\frac{31}{47}$

38. Divide £100 equally among 375 poor people.
Ans. 5s. 4d.

39. Bought 1 cwt. of tea for £30: what is that per lb.?
Ans. 5s. 4¼d. $\frac{1}{7}$

40. Sold 745 acres of wild land for £651 17s. 6d.: what was that per acre? *Ans.* 17s. 6d.

RULE III. When the divisor is also a compound number, *reduce both the divisor and dividend to the lowest name mentioned, and divide as in simple division.*

Divide £6 8s. 3d. by 3s. 4½d.   Divide £99 8s. 5¼d. by £1 11s. 6¾d.

```
  s.   d.      £   s.  d.          £   s.   d.       £   s.   d.
  3   4½)      6   8   3           1  11   6¾       99   8    5¼
 12            20                 20                20
 --            ---                --              ----
 40           128                 31              1988
  4            12                 12                12
 ---          ---                ---             -----
162          1539                378            23861
               4                   4                4
             ----                               -----
    162)6156(38 Ans.              1515         )95445(63 Ans.
        486                                     9090
       ----                                     ----
       1296                                     4545
       1296                                     4545
```

```
1.  113 12  6  ÷  2 10  6  =   45           Ans.
2.   52 18  6  ÷  0 12  2  =   87            ..
3.   11  5  0  ÷  0  1  4½ =  163 7/11       ..
4.   45 11  5½ ÷  0  3  7¾ =  250            ..
5.  815 10  6  ÷  3  7  6  =   97 278/1005   ..
6.   32  3  1½ ÷  0 17  6  =   36¾           ..
```

7. How much cloth, at 15s. 6½d. per yard, can I buy for £95 11s. 7½d.? *Ans.* 123 yards.

8. How many dozen of wine, at £2 2s. 6d. per dozen, can be bought for £297 10s.? *Ans.* 140 dozen.

9. How many gallons of brandy may be purchased for £625 19s. 6d., at 18s. 3d. per gallon? *Ans.* 636 gallons.

10. The revenues of an hospital amount to £1807 8s. yearly: how many boys will it maintain, if each boy cost £18 16s. 6½d.? *Ans.* 96 boys.

11. A gentleman distributed £19 14s. 6d. among some poor people, giving each 10s. 11½d.: how many poor were there? *Ans.* 36.

12. If a man gain 2s. 6d. per day, and spend 1s. 10½d.: how many days must he labour to pay a debt of £11 7s. 6d.? *Ans.* 364.

Note. In Compound Multiplication and Division, when the multiplier or divisor contains a fraction, the rules are the same as those given for Simple Multiplication and Division.

```
      £   s.  d.                £   s.  d.
1.  748 13  7½  ×    8½   =  6363 15   9¾
2.  817 14  9¾  ×   12⅔   = 10358  0  11½
3.   58 15 10   ×   36¼   =  2160 11  10½
```

	£	s.	d.				£	s.	d.	
4	160	9	$6\frac{1}{2}$	×	$70\frac{5}{8}$	=	11333	13	$10\frac{1}{2}$	$\frac{1}{4}$
5.	94	12	8	×	$84\frac{5}{12}$	=	7988	12	$7\frac{1}{4}$	$\frac{1}{8}$
6.	503	8	$9\frac{3}{4}$	×	$110\frac{3}{4}$	=	55756	0	$11\frac{3}{4}$	$\frac{1}{4}$
7.	80	16	10	×	$144\frac{7}{8}$	=	11711	13	$8\frac{3}{4}$	
8.	953	11	$5\frac{1}{2}$	÷	$6\frac{1}{2}$	=	146	14	$0\frac{1}{4}$	$\frac{5}{13}$
9.	74	7	$3\frac{1}{2}$	÷	$11\frac{3}{4}$	=	6	6	$6\frac{3}{4}$	$\frac{39}{47}$
10.	817	15	8	÷	$23\frac{4}{7}$	=	34	13	$10\frac{1}{2}$	$\frac{14}{165}$
11.	52	10	10	÷	$65\frac{5}{8}$	=	0	16	0	$\frac{64}{105}$
12.	1760	17	$4\frac{1}{2}$	÷	$81\frac{1}{12}$	=	21	14	4	$\frac{26}{973}$
13.	48	9	7	÷	$137\frac{7}{8}$	=	0	7	$0\frac{1}{2}$	$\frac{26}{1117}$
14.	506	11	11	÷	$303\frac{4}{11}$	=	1	12	$10\frac{1}{4}$	$\frac{117}{848}$

MISCELLANEOUS EXERCISES IN THE COMPOUND RULES.

1. A person's income is £96 a year, and he spends on an average £1 3s. 3¾d. per week: how much does he save yearly?
Ans. £35 7s. 9d.

2. How much will the wages of 13 men amount to in 7 weeks, at 1s. 10d. per day each? *Ans.* £50 1s.

3. If scissors are bought at 4s. 9d. per dozen, and retailed at 6½d. per pair: how much is gained on 5 dozen? *Ans.* 8s. 9d.

4. C. borrowed from D. £120; of which he has paid at one time £40, at another time £19 19s. 6d., at another £16 8s. 4d., at another £6 17s. 4d., and at another £30: how much has he paid in all, and what remains to pay?
Ans. £113 5s. 2d. paid, £6 14s. 10d. to pay.

5. Divide £3 10s. among 5 men and 6 women, and give each man thrice the share of a woman.
Ans. A man's share 10s., a woman's 3s. 4d.

6. A piece of cloth, at 8s. 4d. per yard, cost £18 15s.: how many yards were in it? *Ans.* 45 yards.

7. What cost 9⅜ gallons, at 19s. 7½d. per gallon?
Ans. £9 3s. 11¾d. ¼

8. A gentleman's income is £960: what should be his daily expenses to save £150 per annum? *Ans.* £2 4s. 4½d. $\frac{30}{73}$

9. A gentleman gave £5 13s. 4d. among some poor people, giving each 6s. 8d.: how many were there? *Ans.* 17.

10. A workman earned on Monday 4s. 7d., on Tuesday 3s. 10d., on Wednesday 5s. 4d., on Thursday 2s. 6d., on Friday 6s. 2d., and on Saturday 3s. 8d.: what did his week's wages amount to? *Ans.* £1 6s. 1d.

11. A labourer earns 15s. 6d. per week: how much should he spend per week, to save £11 for his house rent and clothes?
Ans. 11s. 3d. $\frac{3}{13}$

12. A servant having contracted a debt of £2 6s. 8¼d, allows 9½d. of his wages to lie in his master's hands every week for the payment of it: in what time will this liquidate the debt? *Ans.* 59 weeks.

13. In 48 purses, each containing a joannes, a moidore, a half-guinea, and a half-crown: how many pounds? *Ans.* £182 8s.

14. If 13¾ yards cloth cost £8 17s. 7¼d.: what is that per yard? *Ans.* 12s. 11d.

15. Divide £394 11s. 7d. among 5 men and a boy, and give the boy half of a man's share.
Ans. A man's share £71 14s. 10d., the boy's £35 17s. 5d.

16. A labourer's house rent is £3 13s. 8d. yearly: how much must he lay by weekly in order to pay it? *Ans.* 1s. 5d.

17. Lent £105, and received £66 14s. 8d.: how much is yet due to me? *Ans.* £38 5s. 4d.

18. What is the price of 83 yards of India nankeen, at 1s. 9¾d. per yard? *Ans.* £7 10s. 5¼d.

19. A servant went to market with a ten pound note, and bought as follows:—beef 19s. 5d., mutton 7s. 6d., lamb 25s. 4d., vegetables 2s. 3d., eggs 3s. 4d., butter 14s. 8d., cheese 31s. 4d.: how much did she bring home? *Ans.* £4 16s. 2d.

20. Bought 96 pair of stockings for £19 10s.: at what rate must I sell them per pair, to gain £4 4s. 6d. by them? *Ans.* 4s. 11¼d. ¼

21. Paid £88 13s. for a lot of cloth measuring 69½ yards: at what rate did I buy it per yard? *Ans.* £1 5s. 6d. $\frac{18}{139}$

22. A certain person said if he were to present each of his grand children with three half-dollars, he should spend exactly £24 15s.: how many had he? *Ans.* 66.

23. A bankrupt compounds with his creditors at 13s. 6d. per £: how much will W. receive, to whom he owes £425? *Ans.* £286 17s. 6d.

24. A person who spent at an average 18s. 4½d. per day, saved £52 10s. last year: required his income. *Ans.* £387 16s. 10½d.

25. At a public dinner, the bill amounted to £16 10s., each person paying 5s. 6d.: how many dined? *Ans.* 60.

26. A piece of linen containing 25½ yards, was bought for £4 9s. 3d.: what was that per yard? *Ans.* 3s. 6d.

27. A merchant sold 50 yards linen at 3s. 9d., but allowed a discount of $\frac{1}{20}$ for cash: how much did he receive for the linen? *Ans.* £8 18s. 1½d.

28. After the death of a gentleman, it was found in his will that he had left to his widow £800, to his eldest son

£1080 16s., to each of his other three sons £500 15s. 6d., to each of his two daughters £300 14s. 9d., to five of his near relatives each £50 12s. 6d., to his servants £30 17s. 8d., and to the poor of the parish £10 19s. 10d.: how much did he leave in all?   *Ans.* 4279 12s.

29.   Divide £26 3s. 11½d. among 4 men, 6 women, and 8 children, giving each man double a woman, and each woman triple a child.
>   *Ans.* A child's share, 10s. 5¾d.; a woman's share, £1 11s. 5¼d. ; a man's share, £3 2s. 10½d.

30.   A merchant paid £89 6s. 5½d. for 5 pieces of cloth, each 25 yards: at what must he sell it per yard to gain £8 17s. 6d. on the whole?   *Ans.* 15s. 8½d. $\frac{4}{25}$

31.   If a workman gains every week 18s. 6d., and spends 10s. 4½d.: how much does he save in a year? *Ans.* £21 2s. 6d.

32.   If a man earns 3s. 9d. per day, and spends 1s. 8½d.: how much does he lay by in a year?   *Ans.* £37 5s. 2½d.

33.   A certain gentleman lays up every year £294 12s. 6d., and spends daily £1 12s. 6d.: I desire to know his annual income.   *Ans.* £887 15s.

34.   A gentleman's annual income was £586 18s. 4d.; his household expenses in the same time amounted to £285 16s. 8d., his rent was £65 16s., taxes £14 16s. 10d., servants' wages £56 18s. 6d., tradesmen's accounts £42 13s. 9d., and incidental expenses £14 10s.: how much did he save?
>   *Ans.* £106 6s. 7d.

35.   Received a guinea to pay an account of 16s. 3½d. what balance have I to return?   *Ans.* 4s. 8½d.

36.   If 9$\frac{5}{16}$ yards cost £8 7s. 7½d.: what is that yer yard?
>   *Ans.* 18s.

37.   In what time will a debt of £9 16s. be discharged by weekly payments of 3s. 6d.?   *Ans.* 56 weeks.

38.   A gentleman left his whole effects, amounting to £25816 10s., to his son and 11 nephews; the son was to get ⅕ of the whole, the remainder was to be equally divided among his cousins; how much did the son get, and what did each of his cousins receive?
>   *Ans.* £5163 6s. son, £1877 11s. 3¼d. $\frac{1}{11}$ each cousin.

39.   A. B. and C. receive £89 19s. 7½d.; now A. and B. receive £64 6s. 7¾d., and B. and C. receive £55 10s. 10d.: how much does each receive?
>   *Ans.* A. £34 8s. 9½d., B. £29 17s. 10¼d., C. £25 12s. 11¾d.

40.   A merchant paid £64 18s. for 288 yards cloth, which, getting damaged, he is content to lose £1 13s. by it: at what must he sell it per yard?   *Ans.* 4s. 4½d. $\frac{5}{8}$

41. If a gentleman's income be £37 16s. 9d. per week, and his expenses £25 12s. 6d.: how many weeks will he be in paying off a bond of £525 ?   *Ans.* 42 $\frac{2898}{2931}$ weeks.

42. A. B. C. and D. together owe F. £1242 10s. 2½d.; A. owes him £243 16s. 8½d., B. owes £381 19s. 2¾d., and C. £497 11s. 7¼d.: how much does D. owe him?
        Ans. £119 2s. 8d.

43. How many dollars, half-dollars, and sixpences, and of each an equal number, are in £20 ?   *Ans.* 50.

44. A maid went to market with a five-pound note, and laid out on butcher meat 14s. 8½d., on cheese 8s. 5½d., on eggs 2s. 3d., on butter 3s. 4d., on tea 15s. 6d., and on sugar 5s. 2d.: how much money ought she to have brought home?
        Ans. £2 10s. 7d.

45. Required the price of 20 horses, costing one with another £23 16s. 9½d. each.   *Ans.* £476 15s. 10d.

46. If a person's income be 4s. 6d. per day, and his expenses £71 1s. 6d. per annum : how much does he lay up or overspend per annum, and how much does he spend weekly ?
        Ans. £11 1s. laid up, £1 7s. 4d. $\frac{1}{26}$ weekly expense.

47. How many lbs. of cotton wool, at 2s. 3½d., may be bought for £43 6s. 3d. ; and how may it be sold per lb. to gain £11 0s. 6d. on the whole?   *Ans.* 378 lb. Sold at 2s. 10¼d.

48. A merchant bought broad cloth at 22s. 6d. per ell English: how may he retail it per yard to clear 2d. on every shilling which it cost him ?   *Ans.* 21s.

49. Bought 24 pieces of cloth, each containing 30 yards, for £840 17s. 6d. ; and sold 400 yards of it, at 24s. 3d. per yard: how must I sell the remainder per yard to gain £84 2s. 6d. upon the whole?   *Ans.* £1 7s. 6d.

BILLS OF PARCELS, OR INVOICES.

A Bill of Parcels or Invoice is an account of goods given when bought, showing their quantity and price.

Quebec, July 27th, 1846.

Mr. Christian Hoffman,

Bought of John MacNider.

4 yards Lawn .... @ 2s. 8d.	......	£0	10	8
7 yards Shalloon .... @ 1s. 7d.	......	0	11	1
8 yards Serge .... @ 1s. 8½d.	......	0	13	8
11 yards Lace .... @ 7s. 4d.	...:..	4	0	8
12 yards Muslin........................ @ 5s. 3d.	......	3	3	0

£8 19 1

1. Miss Gouinlock,

Bought of Henry Wholesale.

15 yards Cambric..................... @   8s. 3d.   ...... £
 9 yards Satin .... @   7s. 6d.   ......
24 yards Printed Calico .... @   1s. 4½d. ......
11 yards Flowered Silk .... @ 15s. 0d.   ......
43 yards Irish Linen .... @   3s. 9d.   ......

<div align="right">£27 10 6</div>

Montreal, August 1st, 1846.

2. John Greatman, Esq.

Bought of Messrs. Molson & Co.

36 gallons Rum .... @ 14s. 10d. ...... £
18 gallons Brandy .... @ 18s. 6d. ......
 7½ gallons Malt Aqua............ @ 12s. 0d. ......
45 dozens Port Wine .... @ 30s. 6d. ......
24 dozens Lisbon Wine .... @ 28s. 9d. ......
10 dozens Mountain Wine ...... @ 20s. 0d. ......

<div align="right">£160 19 6</div>

3. Mr. Timothy Trusty,

Bought of G. & J. Gouinlock.

 5½ yards superfine Black Cloth ... @ 28s. 6d. ... £
12 yards superfine Spanish Blue .. @ 30s. 0d. ...
 8½ yards fine narrow ditto   ... @ 9s. 6d. ...
17 yards Drab Cassimere .... @ 6s. 4d. ...
 4 lbs. Young Hyson Tea .... @ 4s. 9d. ...
25 lbs. Refined Sugar .... @   10½d. ...

<div align="right">£37 6 0½</div>

4. Mr. James Ruthven,

Bought of William Oliver.

14 gallons Malt Aqua .... @ 10s. 6d. ...... £
13 gallons Rum .... @ 18s. 6d. .....
12 gallons Hollands .... @ 24s. 6d. ......
 9 gallons Brandy .... @ 35s. 6d. ......
15 dozens Port Wine............. @ 42s. 6d. ......
16 dozens Sherry .... @ 39s. 6d. ......

<div align="right">£113 10 6</div>

D

5.   Mr. B. Parsons,

Bought of John Ruthven.

17 reams large thick Post......... @ 41s. 7d. .... £
23 reams small thick Post ...... @ 32s. 9d.. ......
13 reams superfine laid Foolscap @ 20s. 3d. ......
16 reams coloured quarto Post... @ 25s. 8½d. .....
18 reams wove Post .... @ 24s. 11½d. ...
21 reams common Cap .... @ 19s. 11d. ...

$$\text{\underline{\hspace{3cm}}}$$

£150 1 11

Toronto, 27th July, 1846.

6.   Mr. Henry Williamson,

Bought of J. & W. Allan.

27½ yards superfine Black Cloth ... @ 21s. 8d. ... £
17¾ yards Blue Cloth................. @ 23s. 6d ...
15⅜ yards Olive Cloth .. .. @ 14s. 9d. ...
23¼ yards Mixt Cloth .... @ 17s. 10d....
34¾ yards Black Cassimere .. .. @   6s. 4½d....

£94 0 2¼

7.   Mr. J. Anderson,

Bought of W. Bates & Co.

13¼ lbs. Green Tea .... @   9s. 6½d. ...... £
17¼ lbs. Hyson Skin............... @   7s. 3½d. ......
26¾ lbs. Souchong .... @   8s. 11¼d......
19½ lbs. Pekoe .... @ 10s. 8½d. ......
27 lbs. Raw Sugar .... @   8¼d. ......
35 lbs Refined Sugar .... @   11¾d. ......

£37 12 10¾

8.   Mr. William Brown,

Bought of John Fisher.

 56 cwt. Raw Sugar .... @ 54s. 8d. ...... £
 29 boxes Oranges............. ..... @ 44s. 11½d. ...
  5 boxes Lemons .... @ 53s. 4¼d ......
150 Sugar Loaves, each 13¼lbs., @ 10¾d. per lb..
  1 tierce of Molasses, 52½ gals. @ 1s. 5½d. per gal.
  1 chest Black Tea, 87½lbs. @ 4s. 3½d. per lb. ...

£343 4 5¼

9. Mr. George Thompson,

Bought of David Wright.

54½ yards superfine Brussels Carpet @ 4s. 10½d. £
71 yards fine Brussels Carpet........ @ 3s. 9d....
67¾ yards superfine English Carpet @ 2s. 11¼d.
29¼ yards fine English Carpet ...... @ 2s. 1¾d.
17⅜ yards Floor Cloth .... @ 5s. 7½d.
15¼ yards ¼⁶ Crumb Cloth .... @ 8s. 9½d.
18 yards Petersham..................... @ 15s. 0d....
25 yards superfine Pilot Cloth ...... @ 7s. 6d....
10 yards Fustian .... @ 2s. 9d....

£75   9   0¾

METHOD OF KEEPING A BOOK OF HOUSEHOLD EXPENSES.

1846.		REC'D.			PAID.		
Jan. 1	Received for house expenses ....£	5	0	0			
2	Paid for 3 bottles Port Wine @ 4s. 3d				0	12	9
3	Paid for Bread 2s. 3d.—Butter 1s.—						
	Beef 5s.				0	8	3
	Paid for Eggs 10½d.—Milk 2s.—two						
	Fowls 2s.				0	4	10½
6	Paid Grocer's bill £2 15s.—1 dozen						
	Porter 5s......				3	0	0
7	Paid Postage of Letters 4s. 3d.—a						
	Tea Pot 6s...				0	10	3
10	Received for the house	2	10	0			
	Paid Butcher's account.............				1	17	6
	Paid for Soap 1s. 8d.—Vegetables 7½d.						
	—Fish 2s.				0	4	3½
15	Paid for 1 gal. Rum 7s. 6d.—Mustard						
	and Pepper 1s.				0	8	6
20	Received for the house	3	5	6			
21	Paid for Potatoes 13s.—Milk 1s.—						
	Postage 3s.				0	17	0
	Paid for Tea 7s. 8d.—Biscuits 9½d.—						
	1 Broom 2s.				0	10	5½
	Cash on hand ....£	2	1	7½			

N. B. The next page must begin with the *Cash on Hand.*

REDUCTION

Teaches to bring a number from one name or denomination into another, without altering its value.

I.   To reduce a number from a higher name to a lower.

RULE.   Multiply by as many of the lower name as make one of the higher, and to the product add the number of the lower, if any.

II.   To reduce a number from a lower name to a higher.

RULE.   Divide by as many of the lower as make one of the higher.

III.   When the higher number does not contain an exact number of the lower.

RULE.   Reduce the given name to some lower one contained in that required, then divide by as many as will reduce it to the required name.

Note.   The following questions are answers to each other.

1.   Reduce £738 to shillings.
2.   Reduce £481 to shillings and pence.
3.   Reduce £728 to shillings, pence and farthings.
4.   Reduce £74 17s. 9¼d. to farthings.
5.   Reduce £83 7s. 8½d. to half-pence.
6.   Reduce 321 guineas to sixpences.

1.   In 14760 shillings, how many pounds?
2.   In 115440 pence, how many shillings and pounds?
3.   In 698880 farthings, how many pence, shillings and pounds?
4.   In 71893 farthings, how many pounds?
5.   In 40025 half-pence, how many pounds?
6.   In 13482 sixpences, how many guineas?

TROY WEIGHT.

1.   Reduce 5698 lbs. to ounces and dwts.
2.   Reduce 674 lbs. to ounces, dwts. and grains.
3.   Reduce 29 lbs. 3 oz. 5 dwts. to dwts.
4.   Reduce 72 lbs. 8 oz. 6 dwts. 16 grs. to grains.
5.   Reduce 65 lbs. 9 grs. to grains.

1.   1367520 dwts., how many oz. and lbs.?
2.   In 3882240 grains, how many dwt. oz. and lbs.?
3.   In 7025 dwts., how many lbs.?
4.   In 418720 grains, how many lbs.?
5.   In 374409 grains, how many lbs.?

APOTHECARIES' WEIGHT.

1. Reduce 236 lbs. to ounces, drams and scruples.
2. Reduce 365 lbs. to ounces, drams, scruples and grains.
3. Reduce 64 lbs. 8 oz. 2 dr. 1 scr. to scruples.
4. Reduce 13 lbs. 6 oz. 7 dr. 1 scr. 18 gr. to grains.
5. Reduce 56 lbs. 6 gr. to grains.

1. In 67968 scruples, how many dr. oz. and lbs.?
2. In 2102400 grains, how many sc. dr. oz. and lbs.?
3. In 18631 scruples, how many dr. oz. and lbs.?
4. In 78218 grains, how many lb.?
5. In 322566 grains, how many lb.?

AVOIRDUPOIS WEIGHT.

1. Reduce 572 tons to cwt. qrs. and lbs.
2. Reduce 79 cwt. to qr. lb. oz. and drams.
3. Reduce 23 tons 16 cwt. 2 qr. 13 lb. to ounces.
4. Reduce 4 tons 17 cwt. 17 lb. 15 oz. to drams.
5. Reduce 27 cwt. 14 lb. to ounces.

1. In 1281280 lb., how many qrs. cwt. and tons?
2. In 2265088 drams, how many oz. lb. qr. and cwt.?
3. In 854096 ounces, how many tons?
4. In 2785776 drams, how many tons?
5. In 48608 ounces, how many cwt.?

MEASURE OF CAPACITY.

1. Reduce 51 qrs. 6 bus. 2 pks. 1 gal. to gallons.
2. Reduce 79 qrs. 7 bus. 3 pks. 1 gal. 2 qts. to quarts.
3. Reduce 37 bus. 3 pks. 1 gal. 1 pt. to pints.
4. Reduce 82 qrs. 2 bus. 2 qts. 1 pt. to pints.
5. Reduce 26 bus. 1 gal. to pints.

1. In 3317 gallons, how many quarters?
2. In 20478 quarts, how many quarters?
3. In 2425 pints, how many bushels?
4. In 42117 pints, how many quarters?
5. In 1672 pints, how many bushels?

LINEAL MEASURE.

1. Reduce 128 miles 6 furlongs to poles.
2. Reduce 76 miles 5 furlongs 26 poles to yards.
5. Reduce ____ miles 7 fur. 12 pls. 2 yds. 2 ft. to inches.
1. In 41200 poles, how many ____
2. In 135003 yards, how many miles ____
3. In 1895352 inches, how many miles?

4. In 533232 lines, how many furlongs?
5. In 292677 feet, how many leagues?

SQUARE MEASURE.

1. Reduce 83 acres 2 roods 14 poles to poles.
2. Reduce 17 acres 2 roods 24 poles to square yards.
3. Reduce 43 acres 12 poles 12 sq. yards to square fee..
4. Reduce 26 acres 1 rood 32 poles 14 yards 5 feet to feet.
5. Reduce 7 acres 16 poles 26 square yards to square yards.

1. In 13374 poles, how many acres?
2. In 85426 square yards, how many acres?
3. In 1876455 square feet, how many acres?
4. In 1152293 square feet, how many acres?
5. In 34390 square yards, how many acres?

CLOTH MEASURE.

1. Reduce 45 yards 3 quarters 1 inch to inches
2. Reduce 36 yards 1 inch to inches.
3. Reduce 71 English ells 4 quarters 3 nails to nails.
4. Reduce 24 Flemish ells 1 quarter 1 inch to inches.
5. Reduce 75 French ells 4 quarters 2 nails to nails.

1. In 1648 inches, how many yards?
2. In 1297 inches, how many yards?
3. In 1439 nails, how many English ells?
4. In 658 inches, how many Flemish ells?
5. In 1818 nails, how many French ells?

HEAPED MEASURE.

1. Reduce 234 chaldrons to sacks and bushels.
2. Reduce 905 chaldrons to sacks bus. pecks and gals.
3. Reduce 81 chaldrons 8 sacks 2 bus. 1 peck to pecks.
4. Reduce 27 chal. 6 sacks 1 bus. 3 pecks 1 gal. to gallons.

1. In 8424 bushels, how many sacks and chaldrons?
2. In 260640 gallons, how many pecks, bus. sks. and chal. 1
3. In 11769 pecks, how many chaldrons?
4. In 7935 gallons, how many chaldrons?

CUBIC OR SOLID MEASURE.

1. Reduce 126 cubic yards to cubic inches
2. Reduce 85 solid yards 17,
3. In 3995136 solid inches, how many cubic yards?
3. In 5097600 solid in.. how many loads of hewn timber?
4. In 1218 cubic feet, how many tons of shipping?

COTTON YARN MEASURE.

1. Reduce 26 sp. 3 hks. 4 sks. 26 thds. to threads.
2. Reduce 7 sp. 12 hks. 5 sks. 39 thds. to inches.
1. In 264106 threads, how many spindles?
2. In 4196826 inches, how many spindles?

FLAX YARN MEASURE.

1. Reduce 34 spindles 2 hsp. 3 heers 1 cut to threads.
2. Reduce 81 spindles 26 inches to inches.
1. In 199560 threads, how many spindles?
2. In 41990426 inches, how many spindles?

MOTION.

1. Reduce 8 signs 16° 26′ to minutes.
2. Reduce 9 signs 21° 17′ 14″ to seconds.
1. In 15386 minutes, how many signs?
2. In 1048634 seconds, how many signs?

TIME MEASURE.

1. Reduce 1 Julian year to hours.
2. Reduce 1 leap year to minutes.
3. Reduce 1 solar year to seconds.
4. Reduce 181 days 11 hours 18 minutes to minutes.
5. Reduce 168 days 16 seconds to seconds.
1. In 8766 hours, how many Julian years?
2. In 527040 minutes, how many leap years?
3. In 31.556,928 seconds, how many solar years
4. In 261318 minutes, how many days?
5. In 14,515,216 seconds, how many days?

The following questions exemplify the 3rd Rule:

1. Reduce 128 English ells to yards.
2. Reduce 555 Flemish ells to English ells.
3. Reduce 314 half-crowns to shillings.
4. Reduce 216 moidores to sovereigns.
5. Reduce 810 angels to joanneses.
6. Reduce 864 marks to shillings.
7. Reduce 904 lbs. troy to lbs. avoirdupois.

1. In 160 yards, how many English ells?
2. In 333 English ells, how many Flemish ells?
3. In 785 shillings, how many half-crowns?
4. In 291 sovereigns 12 shillings, how many moidores?
5. In 225 joanneses, how many angels?
6. In 11520 shillings, how many marks?
7. In 743 lb. avoirdupois 6040 grains, how many lb. troy?

ADDITION OF WEIGHTS AND MEASURES.

(1)
TROY WEIGHT.

lb.	oz.	dwt.	gr.
17	8	16	13
85	5	17	21
34	10	8	18
73	7	14	5
47	9	13	19
62	4	19	14
59	6	5	22

(2)
APOTH. WEIGHT.

oz.	dr.	scr.	gr.
14	7	0	16
85	3	1	9
47	6	2	15
70	1	0	8
36	5	2	17
93	4	1	6
28	2	0	12

(3)
AVOIR. WEIGHT.

cwt.	qr.	lb.	oz.
35	1	24	13
74	2	16	10
23	0	8	6
96	1	20	15
18	2	15	9
65	1	9	10
57	0	14	7

(4)
LINEAL MEASURE.

ms.	fur.	po.	yds.
74	5	27	4
16	3	31	3
85	1	16	1
27	4	10	0
60	7	28	5
39	0	15	2
95	6	18	3

(5)
CLOTH MEASURE.

yds.	qr.	na.	in.
73	1	3	1
49	0	1	2
57	3	0	0
85	2	2	1
16	1	3	0
30	0	1	1
17	3	2	2

(6)
SQUARE MEASURE.

ac.	ro.	pe.	yds.
38	3	34	4
76	1	27	3
65	2	16	1
59	0	30	5
80	3	18	0
26	1	21	4
95	2	18	2

SUBTRACTION OF WEIGHTS AND MEASURES.

(1)
TROY WEIGHT.

lb.	oz.	dwt	gr.
95	3	12	10
28	10	15	21

(2)
AVOIR. WEIGHT.

tons.	cwt.	qr.	lb.
70	12	1	14
19	16	3	19

(3)
LINEAL MEASURE.

po.	yd.	ft.	in.
31	1	0	1
16	3	2	9

(4)
SQUARE MEASURE.

ac.	ro.	per.	yd.
70	1	24	2
48	3	37	5

(5)
MEASURE OF CAPACITY.

bus.	pe.	gal.	pts.
64	3	0	3
17	3	1	5

(6)
TIME.

da.	ho.	mi.	se.
53	14	31	17
8	14	52	38

MULTIPLICATION OF WEIGHTS AND MEASURES.

1. 18lb. 6oz. 13dwt. 8gr.   ×   8 = 148lb. 5oz. 6dwt. 16gr..
2. 74 tons 12cwt. 1qr. 16lb. × 12 = 895 tons 8 cwt. 2 qr. 24lb.
3. 53mi. 5fur. 17po. 4yd.   × 32 = 1717mi. 6 fur. 7 po. 1½ yd.
4. 48ac. 2ro. 31per. 3yd.   × 45 = 2191ac. 0ro. 39 per. 14yd.
5. 63bus. 2pe. 1gal. 6pts.   × 66 = 4205 bus. 1pe 1gal. 4 pts.
6. 85 da. 9 ho. 25 mi. 9 sec. × 84 = 7172da. 23ho. 12m. 36sec.

DIVISION OF WEIGHTS AND MEASURES.

1. 63cwt. 1qr. 23lb. 13oz.   ÷   5 = 12cwt. 2qr. 21lb. 9oz.
2. 75ac. 3ro. 19po. 4½yd.   ÷   9 = 8ac. 1ro. 28per. 24yd.
3. 59bus. 1pe. 1gal. 5pts.   ÷ 24 = 2bus. 1pe. 1gal. 6$\frac{11}{24}$pts.
4. 84lb. 9oz. 11dwt. 18gr.   ÷ 84 = 1lb. 0oz. 2dwt. 6$\frac{11}{14}$ grs.
5. 97mi. 3fur. 35po. 3yd.   ÷ 65 = 1mi. 3fur. 39po. 5$\frac{3}{65}$ yd.
6. 83da. 17ho. 45mi. 30sec. ÷ 73 = 1da. 3ho. 31mi. 51$\frac{27}{73}$ sec.

1. In £51, how many shillings, groats, pence, sixpences and half-pence ?
      Ans. 1020s. 3060 gr. 12240d. 2040 sixp. 24480 halfp.

2. How large is an estate consisting of 10 farms, each measuring upon an average 148 acres 2 ro. 25 per. 26 sq. yds.?
          Ans. 1486 a. 2 r. 18 p. 18 yds.

sold of niece of silk measured 42 yds. 3 qrs., and there were 2 na., 12 yds. 2 qrs. 1 niroes, 10 yds. 3 qrs. 3 na., 9 yds. 1 qr. remained ?

4. How many hhds. of sugar, each 11½ cwt., were 2 na. tained in 141,680 lbs. ?   *Ans.* 110.

5. In 25 moidores, how many shillings, pence, twopences, sixpences, crowns, half-crowns, threepences and farthings?
      Ans. 675s. 8100d. 4050 twop. 1350 sixp. 135 cr.
                 270 half-cr. 2700 threep. 32400 far.

6. How far will a man travel in 52 days, at the rate of 35 miles 5 furlongs and 36 poles per day ?
          Ans. 1858 m. 2 fur. 32 po.

7. How many seconds are in one year, of 365 days, 5 hours, 48 minutes and 48 seconds ?   *Ans.* 31556928 sec.

8. What is the weight of 6¾ hhds, at 4 cwt. 3 qrs. 11 lb. per hhd. ?   *Ans.* 32 cwt. 2 qrs. 25¼ lb.

9. How many canisters, each holding 12 lb., can I fill out of 25 cwt. 2 qrs. 24 lb. of tea ?   *Ans.* 240 canisters.

10. How many inches will reach round the terrestrial globe, it being 360 degrees, each degree being 69½ miles?
                                        Ans. 1576713600 inches.

11. A common of 500 acres is to be divided among five proprietors, according to the value of their estates which border upon it; A. gets 59½ acres, B. 76¼ acres, C. 106 a. 2 r. 16 p., D. 94 a. 0 r. 38 p., and E. the rest: required his share?
                                        Ans. 163 a. 1 r. 26 per.

12. If 13 silver spoons weigh 1 lb. 7 oz. 13 dwt. 6 gr., what is the weight of one?   *Ans.* 1 oz. 10 dwt. 6 gr.

13. In £147, how many nobles, pence, sixpences, half-crowns and shillings?
          Ans. 441 no. 35280d. 5880 sixp. 1176 h. c. 2940s.

14. The distance between Toronto and Cobourg is 67 miles: how often will a coach wheel of 15 feet circumference revolve in performing the journey?   *Ans.* 23584 times.

15. How many small enclosures, each 8 ac. 2 ro. and 27 per., can be made out of a common containing 260 acres and 10 poles?   *Ans.* 30 enclosures.

16. How many spoons, each 2 oz. 6 dwt., can be made out of an old silver vessel, weighing 5 lb. 2 oz. 2 dwt.?   *Ans.* 27.

17. In £26, how many dollars, half-dollars, and sixpences, and of each an equal number?   *Ans.* 65 of each.

18. In a puncheon of rum (84 gallons), how many gallons, quarts and pints, and of each an equal number?
                                        Ans. ng̃, 1lb. of silver

19. What is the weight of   *Ans.* 3 dwt. 15 $\frac{3}{11}$ grs.
being coined ... ... weight of a sterling sovereign, 1 lb. of gold
... ... coined into 46 $\frac{39}{40}$ sovereigns?   *Ans.* 5 dwt. 3 $\frac{171}{823}$ grs.

21. Light runs through the space of 1000 diameters of the earth in one minute: how many yards is that, supposing the diameter of the earth to be 8000 miles?
                                        Ans. 14.080,000,000 yards.

22. How many yards of cloth, 8 quarters broad, will line a piece of tapestry that is 24 feet long, and 8 feet broad?
                                        Ans. 10⅔ yards.

23. In 20 guineas, and the same number of half guineas, quarter guineas, crowns, half-crowns and shillings: how many half-pence?   *Ans.* 21720 half-pence.

24. Two men depart from the same place, the one goes directly north 14 miles per day, the other south 22 miles per day: how far are they asunder on the 24th day?
                                        Ans. 864 miles.

25. How many farthings are there in 2222 pieces, each 3s. 10½d.? *Ans.* 413292 farthings.

26. A gentleman's expenses are on an average £1 14s. 6½d. per day: how many days will £630 7s. 8½d. meet his expenditure? *Ans.* 365 days.

27. What is the difference between 10 square miles and 10 miles square? *Ans.* 90 square miles.

28. In general, a township in Canada is 12 miles square: how many acres are in a township? *Ans.* 92160 acres.

29. One day, to my surprise, said a young lady, I found my pocket expenses since the 1st of January, amounted to £15 10s. ; now grandma' allows me only 7s. 9d. per week for pocket money ; pray tell me on what day of the year I made this discovery, and how many weeks after the 1st of January? *Ans.* October 7th ; 40 weeks.

30. How many lbs. of silver in 2 dozen dishes, each dish weighing 25 oz. 15 dwts., and 2 dozen plates, each 15 oz 15 dwts. 22 grains? *Ans.* 83 lb. 1 oz. 2 dwts.

QUESTIONS FOR EXAMINATION IN THE COMPOUND RULES
AND REDUCTION.

What is Compound Addition ? How do you place the numbers to be added ? What is Compound Subtraction ? Do you place the numbers the same as in Addition? What is Compound Multiplication ? When the multiplier does not exceed 12, how do you multiply ? When the multiplier is a composite number, what do you multiply by ? When the multiplier is not a composite number, how do you proceed ? What is Compound Division ? Are not the varieties of Compound Division similar to those of Compound Multiplication ? Yes, and they all prove each other. How do you know a Compound Multiplication question from a Compound Division one ? *Ans.* When the price of one is given to find the price of a number is given to find the price of a number. When the price is multiplication ; and when the price not the compound rules are necessary in common life and for mercantile calculations. What is a Bill of Parcels or Invoice ? What is Reduction ? How do you reduce a number from a higher name to a lower ? How do you reduce a number from a lower name to a higher ? How do you reduce pounds to shillings, pence and farthings ? How do you reduce farthings to pence, shillings and pounds ? Repeat Troy Weight table. What articles are weighed by Troy Weight. Repeat Apothecaries' Weight.

What is this weight used for? Repeat Avoirdupois weight.
For what purpose is it used? Repeat the general Measure of
Capacity. What articles are measured by it? Repeat Lineal
Measure. What is the use of this measure? Repeat Square
Measure. What is the use of square measure? Repeat Cloth
Measure. For what is it used? Repeat Time Measure. What
is measured by it? Repeat the 12 calendar months. How do
you remember the number of days in each?

PART III.

SIMPLE PROPORTION.

Four numbers are proportional, when the first contains the
second as often as the third contains the fourth; or when the
first, multiplied by any number, contains the second as often as
the third, multiplied by the same number, contains the fourth.

RULE FOR STATING.

The three given numbers must be placed in one line. First,
write down the given quantity of the thing sought; that is, of
yards, if yards be sought; of money, if money be sought, &c.

If the number sought is to be greater than that written down,
place the greater of the other two towards the right hand; but
if it is to be less, place the less on the right hand of the other.

RULE FOR WORKING.

The two like terms are first to be reduced to the same name,
and the other to the lowest name in it.

Then multiply the two right hand terms together, and divide
the product by the left hand term; the quotient will be the
answer of the same name with the term first written down, or
of the name it was reduced to.

will 4C----res of land maintain 16 horses: how many horses

	ac.	ac.	hor.
Write 16 horses first, because horses are sought; and as 27 acres will maintain more horses than 12 acres, write the greater, 27, towards the right of 12.		27	: : 16
		162	
		27	
	12)432		

Ans. 36 horses.

If 24 horses be maintained on hay for a certain sum, when hay is at 10d. per stone: how many will be maintained for the same sum when the price of hay is 1s. per stone?

		d.		d.		horses.
		12	:	10	: :	24
						10

After writing 24 horses, then fewer will be maintained, because the hay is dearer, therefore the less, 10d., is written to the right of 12d.

(240

Ans. 20 hors.

Note. If the first term (which is always the divisor) and either of the other two, are measured by the same number, divide them by it, and use the quotients instead of them. Technically, this is called cancelling, and it is of the greatest importance to get pupils to understand it thoroughly, as it shortens the work in many questions, in various rules.

	yd.		yd.		£	s.	d.
	57	:	152	: :	55	4	4½
If 57 yards of cloth cost £55 4s. 4½d.: what will 152 yards come to?	19		8		18	8	1½
							8

Ans. £147 5 0

In this question 3 divides 57 down to 19, and £55 4s. 4½d. to £18 8s. 1½d.; again, 19 divides or cancels 152 to 8; hence £18 8s. 1½d. multiplied by 8 must be the answer. Always draw a horizontal line through the figures you cancel.

	days.		days.		£	s.	d.
A man's yearly wages are £37 4s. 1d.: what are they for 73 days?	365	:	73	: :	37	4	1
	5						

Ans. £7 8 9⁴¹⁄₇₃

Here 73 cancels 365 down to 5; hence £37 4s. 1d. divided by 5 gives the answer.

	yd.		yd.		£	s.	d.
	48	:	108	: :	15	12	4
What will 108 yards cloth come to, when 48 yards cost £15 12s. 4d.?	4		9				9
					4)140	11	0

Ans. £35 2 9

Here 12 cancels 48 and 108 down to 4 and 9, therefore £15 12s. 4d. multiplied by 9 and divided by 4 gives the answer

1. If 4 yards of cloth cost 3s.: what will 24 yards cost ?*
                                                    Ans. 18s.

2. If 24 yards of cloth cost 18s.: what will 4 yards cost ?
                                                    Ans. 3s.

3. If I get 4 yards of cloth for 3s.: how many will I get for
18s.?   *Ans.* 24.

4. If I get 24 yards for 18s.: how many will I get for 3s.
                                                    Ans. 4.

5. If 24 yards cloth cost 36s.: what will 141 yards cost ?
                                            Ans. £10 11s. 6d.

6. If 8 yards cost 32s.: what will 51 yards cost ?
                                              Ans. £10 4s.

7. If 7 lb. cost 25s.: what will 49 lb. cost ?   *Ans.* £8 15s.

8. If 17 yards of cloth cost £4 5s.: what will 307 yards
come to ?   *Ans.* £76 15s.

9. If 100 yards of serge cost £5 8s. 4d.: what will 37 yards
cost ?   *Ans.* £2 0s. 1d.

10. If 68 yards cloth cost £17 19s. 10d.: what will 7 yards
cost?   *Ans.* £1 17s. 0½d.

11. If 57 yards of linen cost £8 11s.: what will 98 yards
3 qrs. cost ?   *Ans.* £14 16s. 3d.

12. If 19 lb. of tea cost £4 15s.: what will 3 cwt. 17lb. cost?
                                              Ans. £88 5s.

13. What must I pay for 475 gals. sherry: when 138 gals.
cost £65 11s. ?   *Ans.* £225 12s. 6d.

14. When velvet is 18s. 6d. per yard: what will 6 nails cost?
                                            Ans. 6s. 11¼d.

15. If 3 yards of broadcloth cost £4 8s. 3d.: what will 24½
yards cost ?   *Ans.* £36 0s. 8½d.

16. If 24½ yards of cloth cost £36 0s. 8½d.: what is the
price of 3 yards ?

17. If I pay £36 0s. 8½d. for 24½ yards of cloth : what
quantity can I purchase for £4 8s. 3d. ?

18. If I pay £12 8s. for 32 yards of rich flowered silk : what
quantity can I purchase for £111 12s. ?   *Ans.* 288 yards.

---

* The three following questions are deduced from this, and every
example admits of being varied in the same manner.

When the terms of a question are so connected, that while one is
increased the other increases, or is diminished the other diminishes,
the question is said to be in *direct* proportion. But if, while the
one is increased the other diminishes, or the contrary, the question
is said to be *inverse* proportion   The first thirty-six examples are
direct, the next ten inverse ; the others are direct and inverse pro-
miscuously. The rule for stating is so constructed as to suit both
direct and inverse alike.

19. How much steel may be bought for £9 16s. 10½d., when 14 lb. cost 10s. 11¼d.? *Ans.* 2 cwt. 1 qr.

20. What is the price of 3 pieces of cloth, each containing 25 yards, at £4 19s. 11½d. for 17 yards? *Ans.* £22 9s. 11¾d.$\frac{11}{17}$

* 21. What do a man's wages amount to in 143 days, at £28 a year? *Ans.* £10 19s. 4$\frac{4}{5}\frac{5}{13}$.

22. Find the value of 4 cwt. 3 qrs. 14 lb. of cheese, at 65s. 4d. per cwt. *Ans.* £15 18s. 6d.

23. Find the value of 1725 stones of hay, at 64s. per 100 stones. *Ans.* £55 4s.

24. What is the price of 57 ells English, at £1 9s. 2d. for 25 yards? *Ans.* £4 3s. 1½d.

25. What is the price of 12 pieces of cloth, each containing 25½ yards, at £20 4s. 8d. for 47 ells Flemish? *Ans.* 175 12s. 10d.$\frac{10}{47}$

26. What is the price of 56 cwt. 3 qrs. 14 lb. of sugar, at 15s. 4½d. for 18 lb.? *Ans.* £272 1s. 0½d.

27. What is the price of 3031 gals. of beer, at £4 6s. 7d. for 54 gals.? *Ans.* £242 19s. 10½d.$\frac{20}{27}$

28. What is the price of 207 acres 15 perches of land, at £26 17s. 6d. per acre? *Ans.* 5565 12s. 10$\frac{3}{4}$

29. What is the price of 17 gallons of oil, at £37 16s. for 84 gallons? *Ans.* £7 13s.

30. What is the price of 574 gals. of wine, at £4 2s. 6d. for 49 gals.? *Ans.* £48 6s. 5d.$\frac{1}{7}$

31. What is the price of 7 cwt. 3 qrs. 18 lb of sugar, at 4s. 4½d. for 11 lb.? *Ans.* £17 12s. 4½d.$\frac{6}{11}$

32. If 43 yards superfine cloth cost £64 7s. 6d.: how many yards may be bought for £193 2s. 6d.? *Ans.* 129.

33. If 10½ yards velveteen cost £1 11s. 6d.: what will 27¾ yards come to? *Ans.* £4 3s. 3d.

34. If 7 cwt. 3 qrs. of tobacco cost £86 16s.: what will 23 cwt. 1 qr. come to? *Ans.* £260 8s.

35. How much will 3½ stones of cheese come to, at £4 13s. 4d. per cwt.? *Ans.* £2 0s. 10d.

36. What is the price of 7 pieces of silver, each 4 lb. 15 dwt., at £18 18s. for 72 ounces? *Ans.* £89 11s. 6¾d.

37. If 42 men perform a piece of work in 108 days: in what time will 72 men do it? *Ans.* 63 days.

38. If 57 masons build a house in 156 days: in what time will 37 masons do the same? *Ans.* 240 $\frac{12}{37}$ days.

39. How many yards of broadcloth, at 15s. per yard, are equal in value to 24 reams of paper, at 17s. 6d. per ream? *Ans.* 28 yards.

40. If I get 1800 lb. of tobacco carried 64 miles for 30s.: how many miles can I have 1200 carried for the same money?
<div align="right">*Ans.* 96 miles.</div>

41. If 12 men consume a certain quantity of provisions in 15 days: how long will the same quantity serve 20 men at that rate? *Ans.* 9 days.

42. If 136 masons can build a fort in 28 days: how many must be employed to finish one equally strong in 8 days?
<div align="right">*Ans.* 476 masons.</div>

43. If 28 reapers finish a harvest in 36 days: how many reapers will do it in 9 days? *Ans.* 112 reapers.

44. If 18 men mow a meadow in 4 days: how many will mow it in 9 days? *Ans.* 8 mowers.

45. How many lbs., at 2s. 9d., are equal in value to 110 lbs. at 4s. 6d.? *Ans.* 180 lbs.

46. A butcher buys a piece of linen, measuring 26 yards, at 2s. 7d. per yard: how much beef, at 10s. 8d. per stone, must he give in return? *Ans.* 6 st. 4 lb. $\frac{5}{32}$

47. If $9\frac{5}{16}$ yards of broadcloth cost £7 2s. $9\frac{1}{2}$d.: what will $33\frac{1}{4}$ yards of the same cost? *Ans.* £25 9s. 10d.

48. If I lend a friend £100 for 12 months: how long should he lend me £150 to requite my kindness? *Ans.* 8 months.

49. A bankrupt's debts amount to £5130, and his effects to £3729 18s. 9d.: how much can he offer his creditors per £?
<div align="right">*Ans.* 14s. $6\frac{1}{2}$d.</div>

50. A bankrupt owes his creditors £4678: how much will he pay them at 11s. 6d. per £? *Ans.* £2689 17s.

51. A bankrupt pays his creditors 13s. 4d. per £, paying them in all £490: what was his debt? *Ans.* £735.

52. A garrison has provisions for 10 months, at the rate of 16 ounces to each person per day: how much may be allowed per day, that the provisions may last for one year?
<div align="right">*Ans.* 13 oz. 6 dwt. 16 gr.</div>

53. At 15 oz. per day for each man, a garrison's provisions will last 8 months: how long will they last if each man is allowed only $12\frac{1}{2}$ oz. per day? *Ans.* 9 months 18 days.

54. If a garrison of 1000 soldiers have provisions for 9 months: how many must be dismissed that the same provisions may last 15 months? *Ans.* 400 men.

55. How much carpeting, yard-wide, will cover a floor, 25 feet long and 18 feet wide? *Ans.* 50 yards.

56. If it cost £26 2s. 6d. to floor a room 30 feet by 22: what will it cost for one 24 by 18? *Ans.* £17 2s.

57. How much tea at 4s. 8d. per lb. ought to be exchanged for 140 lb. at 6s. 8d.? *Ans.* 200 lb.

58. If the arms of a deceitful balance be 12 inches and 11½ inches respectively: what weight on the shorter end will balance 46 lb. on the longer ?   *Ans.* 48 lb.

59. Suppose the arms of a deceitful balance be to each other as 10½ to 10, and suppose a weight of 35 lb. hangs from the end of the shorter arm : what weight hung from the end of the longer arm will produce an equilibrium?   *Ans.* 33⅓ lb.

60. If muslin ⅞ yard wide cost 3s. 6d. per yard : what should be charged for cloth of the same quality ⅞ yard wide ?
Ans. 4s. 6d.

61. If a retailer has 2d. of profit on every shilling he draws, to what extent must he deal to clear £100 ?   *Ans.* £600.

62. What is the interest of £1750 for a year at 5 per cent. per annum ?   *Ans.* £87 10s.

63. What is my commission on £256 18s. at 2½ per cent. ?
Ans. £6 8s. 5¼d. ⅗

64. What is the brokerage of £255, at 4s. per cent. ?
Ans. 10s. 2¼d. ⅗

65. If £425 gain £20 3s. 9d. : what is the rate per cent. ?
Ans. £4 15s.

66. A traveller walks 24 miles a day ; and after he has advanced 42 miles, another follows him, who walks 32 miles a day : in what time will he overtake him ?   *Ans.* 5¼ days.

67. If a stick 4 feet 8 inches long casts a shadow of 5 feet 10 inches : what is the height of a tower whose shadow is 125 feet 6 inches ? •   *Ans.* 100 feet 4⅘ inches.

68. A boy flying his kite with 384 yards of string, tied the end of it to a peg on level ground, and found that a knot 6 feet from the peg was 4½ feet from the ground : how high was the kite ?   *Ans.* 288 yards.

69. A farmer borrowed 192 quarters of wheat, when the price was £2 5s. 6d. : how much should he return in quantity when the price is £2 2s. ?   *Ans.* 208 quarters.

70. If 20 acres of land, worth £21 per acre, be exchanged for 35 acres of other land : what is this last valued at per acre ?
Ans. £12 per acre.

71. The shadow of a cloud was observed to move 36 yards in 5 seconds : what was the hourly motion of the wind ?
Ans. 25,920 yards, or 14$\frac{8}{11}$ miles.

72. If a hare start 120 yards before a greyhound, and run 6 yards whilst the dog runs 8½ : how many yards must the dog run ere he catch the hare ?   *Ans.* 408 yards.

The dog gains 2½ on every 8½ ; hence as 2½ : 8½ : : 120 : 408.

73. A. and B. depart from the same place, and travel along the same road ; but A. sets out 5 days before B., going at the

E

rate of 15 miles per day ; B. follows at the rate of 20 miles per day : what distance must he travel to ovetake A.?

<div align="right">*Ans.* 300 miles.</div>

74. How much cloth, 3 qrs. wide, must be given for 90 yards of equal goodness which is 5 qrs. wide?   *Ans.* 150 yards.

75. A. has cloth at 4s. 6d., which he wants to barter with B. for 84 yards at 7s. 6d.: how many yards must A. give?

<div align="right">*Ans.* 140 yards.</div>

76. If the carriage of 60 cwt. for 120 miles be £15 10s.: how far may I have 210 cwt. carried for the same money?

<div align="right">*Ans.* 34⅔ miles.</div>

77. Bartered 64 yards linen, at 2s. 8d. per yard, for 123 yards cotton : required the barter price of the cotton ?

<div align="right">*Ans.* 1s. 4d. per yard.</div>

78. A. has tea worth 7s. 6d. ready money, but in barter will have 9s. ; B. has cloth worth 2s. 6d. ready money : how must B. rate his cloth to be even with A.?   *Ans.* 3s. per yard.

79. How many yards of cloth, at 7s. 6d., ought to be received for 7 pieces, each 108 yards, at 5s. per yard?

<div align="right">*Ans.* 504 yards.</div>

80. How much cloth, at 7s. 6d. per yard, ought to be given in barter for 3 pieces, each 27 yards, at 5s. 3d. per yard?

<div align="right">*Ans.* 56 yards 2 qrs. 3⅕ nails.</div>

COMPOUND PROPORTION.

When the proportion depends upon several circumstances, it is said to be compound.

One of the given numbers is of the same kind with that required ; and the others, taken two and two, are like one another.

RULE FOR STATING.

Write down the term which is like the number sought ; and first take two numbers of the same kind, and state them as in the simple rule ; then take other two like one another, and state them in the same manner under the former, and so on till all the numbers are stated.

RULE FOR WORKING.

Reduce like terms to the same name ; and that like the number sought, to the lowest name in it.

Multiply the terms below one another successively, which will reduce them to three ; then work as in simple proportion.

If 15 pecks of wheat serve a family of 9 persons for 22 days: how long will 20 pecks of it serve a family of 6 persons ?

<div>

:Days are sought, write 22
days first; now as 20 pecks will
serve longer than 15, put 20 to
the right of 15; and as they
will serve 6 persons longer than
9, put 9 to the right of 6.

</div>

pecks   15 : 20 :. 22 days.
persons   6 : 9
_____
      90 180
        ·22
_____
       360
       360
_____
   9,0)396,0
_____
Ans.   44 days.

For cancelling, it is better to state the question with all the terms in one line.

If £36 value of corn maintain 18 men for 9 months, when corn is at 16s. per boll: how many will be maintained 6 months for £54, when the price is 12s.?

	Divisors.			Dividends.		
s.	m.	£	men.	£	m.	s.
12	6 :: 36 :		18 :: 54	9	16
c	b	a	a	b	d	c
3		2		9	3	4
d		e				e men.

$$9 \times 3 \times 2 = 54 \text{ Ans.}$$

Here 18a cancels 36a down to 2,—6b cancels 54b to 9,—4 cancels c12 and c16 to 3 and 4,—d3 cancels d9 to 3,—e2 cancels e4 to 2:—the divisors being all canceled, the remaining dividends 9 3 2 multiplied together gives the answer.

If 12 men in 15 days build a wall 30 feet long, 6 feet high and 3 feet thick: in what time will 60 men build a wall 300 feet long, 8 feet high, and 6 feet thick?   *Ans.* 80 days.

	Divisors.			Dividends.		
th.	H.	F.	M.	days.	M.	F. H. th.
3 :	6 :	30 :	60 :	15 :: 12 :	300 : 8 : 6
e	c	b	a	a	e	b d c
			4			4 × 10 × 2 = 80 Ans.
			d			

Here a15 cancels a60 down to 4,—b30 cancels b300 to 10, —c6 cancels c6,—d4 cancels d8 to 2,—e3 cancels e12 to 4: —hence the remaining dividends 4 10 2 multiplied together gives the answer. Carefully remember that one divisor must not cancel another divisor, nor one dividend cancel another dividend, but one of the numbers must always be a divisor the other a dividend; and always draw a line through the you cancel in both divisor and dividend.

1. If 3000 copies of a book of 11 sheets require 66 reams of paper: how much paper will be required for 5000 copies of a book of 12½ sheets?   *Ans.* 125 reams.

2. If 8 men in 6 days made 48 roods of ditching: how many roods will 6 men make in 36 days?   *Ans.* 216 roods.

3. If 12 men in 4 days mow 48 acres of grass: how many must be employed to mow 192 acres in 24 days? *Ans.* 8 men.

4. If a person travel 320 miles in 10 days, when the day is 12 hours long: how many miles will he travel in 15 days, when the day is 16 hours long?   *Ans.* 640 miles.

5. If 9 persons pay £18 for 4 weeks board: what sum will discharge the board of 14 persons for 13 weeks?   *Ans.* £91.

6. If 18 men eat 16s. worth of bread in 3 days, when wheat is at 18s. per boll: what value of bread will 45 men eat in 27 days, when wheat is at 15s. per boll?   *Ans.* £15 value.

7. If 8 men can build a wall 20 feet long, 6 feet high, and 4 feet thick, in 12 days: in what time will 24 men build one 200 feet long, 8 feet high, and 6 feet thick?   *Ans.* 80 days.

8. If £100 in 12 months gain £5 interest: what sum will £825 gain in 9 months?   *Ans.* £30 18s. 9d.

9. If £825 gain £30 18s. 9d. in 9 months: what will £100 gain in 12 months?   *Ans.* £5.

10. If £100 in 12 months gain £5 interest: what sum will gain £30 18s. 9d. interest in 9 months?   *Ans.* £825.

11. If £825 gain £30 18s. 9d interest in 9 months: what sum will gain £5 in 12 months?   *Ans.* £100.

12. If £100 in 12 months gain £5: in what time will £825 gain £30 18s. 9d.?   *Ans.* 9 months.

13. If £825 gain £30 18s. 9d. in 9 months: in what time will £100 gain £5?   *Ans.* 12 months.

14. If 8 men accomplish 30 yards of ditching in 12 days, working 8 hours per day: in what time will 12 men finish a ditch, supposing its whole length 60 yards, when they work only 6 hours per day?   *Ans.* 21½ days.

15. If 236 men eat 160 qrs. of wheat in 108 days: how many qrs. will 76 men eat in a year and 67 days?

        Ans. 206$\frac{6}{39}$ qrs.

16. If a chest 8 feet long, 5 feet deep, and 4½ feet wide, hold 24 bolls of oats: how many bolls will a chest 16 feet long, 4 feet deep, and 5 feet wide, contain?   *Ans.* 42⅔ bolls.

17. If 30 cwt. be carried 15 miles for £5 8s. 9d.: how many miles ought 90 cwt. be carried for £29?   *Ans.* 26⅔ miles.

18. If 250 sailors consume 1000 lb. of pork in 1 week: how many sailors will use 19800 lb. in 9 weeks?   *Ans.* 550.

19. If 12 men build a wall 60 feet long, 4 thick, and 20 in height, in 24 days, working 12 hours per day: what length of wall, 3 feet thick and 12 high, will 18 men build in 18 days, working 8 hours per day? *Ans.* 100 feet long.

20. If 336 men, in 5 hours each, dig a trench of 5 degrees of hardness, 70 yards long, 3 wide, and 2 deep: what length of trench, of 6 degrees of hardness, 5 yards wide and 3 deep, may be dug by 240 men in 9 days of 12 hours each? *Ans.* 36 yards.

DISTRIBUTIVE PROPORTION
(COMPANY OR PARTNERSHIP)

Teaches to divide the profits and losses of merchants in company, in proportion to their shares of the capital or stock.

RULE.—As the whole stock is to each particular stock, so is the whole gain or loss to the respective shares of it.

Three men, A. B. and C., make a joint stock; A.'s share is £64, B.'s 88, C.'s 96; they continue in trade until their profits are £108: required their shares.

		£	£	£	£	s.	d.	
A.'s stock £64	As 248	:	64	: : 108	: 27	17	$5\frac{1}{31}$	A.'s gain.
B.'s stock £88	As 248	:	88	: : 108	: 38	6	$5\frac{13}{31}$	B.'s gain.
C.'s stock £96	As 248	:	96	: : 108	: 41	16	$1\frac{17}{31}$	C.'s gain.

£248   £108 0 0 proof.

1. X. Y. and Z. made a joint adventure to Jamaica; X.'s share of the adventure is £230, Y.'s £324, and Z.'s £336; they lose £144: required the share of each.
Ans. X.'s £37 4s. 3d. $\frac{84}{89}$, Y.'s £52 8s. $5\frac{1}{4}$d. $\frac{51}{89}$, Z.'s £54 7s. $3\frac{1}{4}$d. $\frac{43}{89}$

2. A. W. and R. buy a ship for £1750; of which A. paid £840, W. 485, and R. the rest. The net freight for the first voyage was £145 15s.: how much of this sum should each receive? *Ans.* A. £69 19s. $2\frac{1}{4}$d. $\frac{21}{35}$, W. £40 7s. $10\frac{1}{4}$d. $\frac{29}{35}$, R. £35 7s. 11d. $\frac{20}{35}$

3. Four merchants freight a ship to Barbadoes, value of the cargo £1260, whereof A.'s share is £540, B.'s £360, C.'s £240, and D.'s the rest; they gain £220: required each man's share of it. *Ans.* A.'s £94 4s. $8\frac{1}{2}$d. $\frac{2}{7}$, B.'s £62 17s. $1\frac{1}{2}$d. $\frac{6}{7}$, C.'s £41 18s. 1d. $\frac{4}{7}$, D.'s £20 19s. $0\frac{1}{2}$d. $\frac{2}{7}$

4. A. B. and C. continue in trade for a year, with a stock of £1200; at the end of which A.'s gain was £40, B.'s £64, and C.'s 56: required their stocks.
Ans. A.'s stock £300, B.'s £480, C.'s £420

5. A quantity of common, consisting of 240 acres, is to be divided among L. M. and N. in proportion to their estates; L.'s estate is £400 a year, M.'s £350, and N.'s £200: what is each man's share of the common?

Ans. L.'s 101 ac. 8$\frac{8}{19}$ per., M.'s 88 ac. 1 ro. 27$\frac{7}{19}$ per.,
N.'s 50 ac. 2 ro. 4$\frac{4}{19}$ per.

6. A. insures on a ship and cargo £95, B. £90, C. £85, D. £80, E. £75, F. £70, G. £65, H. £60, I. £55, and K. £25; and damages are sustained to the extent of £525: how much must each underwriter pay, and how much will the proprietor lose, the whole value of the property being £1200?

Ans. A. must pay £41 11s. 3d., B. £39 7s. 6d., C. £37 3s. 9d., D. £35, E. £32 16s. 3d., F. £30 12s. 6d., G. £28 8s. 9d., H. £26 5s., I. £24 1s. 3d., K. £10 18s. 9d.; proprietor £218 15s. Loss 8s. 9d. per £.

7. A testator bequeathed to A. 260, to B. 488, to C. £622, and to D. 500, but at his death the net amount of his property was only £1243: how much of this sum should each legatee have received?

Ans. A.'s share £172 16s. 5$\frac{1}{4}$d. $\frac{110}{187}$, B.'s £324 7s. 6$\frac{1}{4}$d. $\frac{77}{187}$, C.'s £413 8s. 11$\frac{1}{4}$d. $\frac{33}{187}$, D.'s £332 7s. 0$\frac{1}{2}$d. $\frac{154}{187}$

8. A bankrupt owes to a £126, to B. £104, to C. £98, to D. £249, to E. £84, and to F. £97; his money and effects amount to £508: how much can he pay per £, and what is the just dividend to each of his creditors?

Ans. 13s. 4$\frac{3}{4}$d. $\frac{143}{379}$ per £. A.'s dividend £84 8s. 10$\frac{1}{4}$d. $\frac{205}{379}$, B.'s £69 13s. 11$\frac{3}{4}$d. $\frac{91}{379}$, C.'s £65 13s. 6$\frac{1}{2}$d. $\frac{370}{379}$, D.'s £166 17s. 6d. $\frac{360}{379}$, E.'s £56 5s. 10$\frac{3}{4}$d. $\frac{263}{379}$, and F.'s £65 0s. 1$\frac{3}{4}$d. $\frac{227}{379}$

9. Three merchants, A. B. and C., bought a West India ship; whereof A. paid $\frac{9}{15}$, B. $\frac{4}{15}$, and C. $\frac{2}{15}$, which amounted to £786 18s. 10d.; in a trading voyage, of two years, they gained £1786, after paying all expenses: how much is each man's share of the gain?

Ans. A.'s share £1071 12s., B.'s £476 5s. 4d., and C.'s £238 2s. 8d.

Note. When the times of their continuing their stock in company are unequal, each stock must be multiplied by the time of its continuance, and use the products; thus—

A. continued his stock of £250 in trade for 3 months, B. continued his stock of £960 for 2 months, and C. his of £540 for 6 months; they gained 480: required their shares.

A's 250 × 3 = 750   As 5910 : 750 : : 480 : £60 18 $3\frac{1}{4}$ $\frac{31}{197}$ A's share.
B's 960 × 2 = 1920   As 5910 : 1920 : : 480 : 155 18 $9\frac{1}{4}$ $\frac{103}{197}$ B's share.
C's 540 × 6 = 3240   As 5910 : 3240 : : 480 : 263 2 $11\frac{1}{4}$ $\frac{63}{197}$ C's share.
      5910   £480 0 0 proof.

10. A. B. and C. had a joint stock of £630 ; A.'s continued only 3 months, B.'s 5 months, and C.'s a year ; also A.'s stock was £215, B.'s £310, and C.'s the rest ; they gained £254 : required their shares.

Ans. A.'s £47 8s. $4\frac{1}{4}$d. $\frac{349}{691}$, B.'s £113 19s. 0d. $\frac{528}{691}$, C.'s £92 12s. $7\frac{1}{4}$d. $\frac{505}{691}$.

11. A. and B. enter into partnership for a year ; A. with £200 and B. with £160 ; after 4 months they admit C. with £120 ; at the end of the year their gain is £150 : what is each man's share of it ?

Ans. A.'s £68 3s. $7\frac{1}{2}$d. $\frac{6}{11}$, B.'s £54 10s. $10\frac{3}{4}$d. $\frac{7}{11}$, C.'s £27 5s. $5\frac{1}{4}$d. $\frac{9}{11}$.

12. Three farmers rent a field of grass for £42 ; A. puts in 48 sheep for 4 months, B. 50 for 2 months, and C. 30 for 3 months : what part of the rent must each farmer pay ?

Ans. A. £21 2s. $2\frac{1}{4}$d. $\frac{105}{191}$, B. £10 19s. $10\frac{1}{2}$d. $\frac{186}{191}$, C. £9 17s. $10\frac{3}{4}$d. $\frac{91}{191}$.

13. A. B. and C. enter into company for a year ; A. puts in £600, but at the end of 8 months he withdraws £200 ; B. puts in £400, and at 6 month's end £200 more ; C. puts in £300, and at the end of 4 months £400 more ; but at the end of 10 months he takes out £200 ; they clear £360 : required their shares.

Ans. A.'s share £122 11s. $0\frac{3}{4}$d. $\frac{3}{47}$, B.'s £114 17s. $10\frac{1}{4}$d. $\frac{41}{47}$, C.'s £122 11s. $0\frac{3}{4}$d. $\frac{3}{47}$.

14. Three graziers rent a grass field, at £30 ; A. puts in 40 oxen for 4 months, B. 60 oxen for 3 months, and C. 20 oxen for 5 months : what part of the rent ought each to pay ?

Ans. A.'s share of rent £10 18s. 2d. $\frac{2}{11}$, B.'s £12 5s. 5d. $\frac{5}{11}$, C.'s £6 16s. 4d. $\frac{4}{11}$.

15. Four merchants, P. Q. R. and S., agree to trade together for 18 months ; P. puts in £300, and at 8 months' end £400 more ; Q. puts in £600, at the end of 4 months takes out £200, and at the end of other 6 months puts in £300 ; R. puts in £700, which continues the whole time ; and S. puts in £275, and at the end of 12 months £1275 more ; they gain £1000 ; what is each man's share ?

Ans. P.'s £208 17s. $9\frac{1}{4}$d. $\frac{1}{3}$, Q.'s £231 2s. $2\frac{1}{2}$d. $\frac{2}{3}$, R.'s £280, S. £280.

PRACTICE

Is a short and easy method of finding the value of any number greater than 156, by taking *even* or aliquot parts.

TABLE OF ALIQUOT PARTS.

Of a pound.	Of a shilling.	Of a cwt.	Of a quarter.
10s. $= \frac{1}{2}$£	6d. $= \frac{1}{2}$s.	2 qrs. $= \frac{1}{2}$c	4 lb. $= \frac{1}{2}$q
6s. 8d. $= \frac{1}{3}$	4 $= \frac{1}{3}$	1 $= \frac{1}{4}$	3½ $= \frac{1}{8}$
5 0 $= \frac{1}{4}$	3 $= \frac{1}{4}$	16 lb. $= \frac{1}{7}$	Of an oz. troy.
4 0 $= \frac{1}{5}$	2 $= \frac{1}{6}$	14 $= \frac{1}{8}$	10 dwt. $= \frac{1}{2}$o
3 4 $= \frac{1}{6}$	1½ $= \frac{1}{8}$	8 $= \frac{1}{14}$	6 16 gr. $= \frac{1}{3}$
2 6 $= \frac{1}{8}$	1 $= \frac{1}{12}$	7 $= \frac{1}{16}$	5 $= \frac{1}{4}$
2 0 $= \frac{1}{10}$			4 $= \frac{1}{5}$
1 8 $= \frac{1}{12}$	Of a penny.	Of a quarter.	3 8 $= \frac{1}{6}$
1 4 $= \frac{1}{15}$	2 far. $= \frac{1}{2}$d.	14 lb. $= \frac{1}{2}$q	2 12 $= \frac{1}{8}$
1 0 $= \frac{1}{20}$	1 $= \frac{1}{4}$	7 $= \frac{1}{4}$	2 $= \frac{1}{16}$

CASE I. When the price is an even part of a penny, shilling, or pound.

RULE. Divide the given quantity by the part which the price is of a penny, shilling, or pound, and the quotient will be the answer in pence, shillings, or pounds, respectively.

What is the price of	What is the price of
6s. 8d. | ⅓ | 857 yards, at 6s. 8d.	1½ | ⅛ | 5475 lb. at 1½d
——	——
£285 13 4 ans.	20 | 684 4½
	——
	£34 4 4½ ans.

Find the value

1.	of 973 yards @	2s. 6d.	...	Ans. £121	12	6
2.	of 614 yards @	1s. 8d.	...	51	3	4
3.	of 466 yards @	6s. 8d.	...	155	6	8
4.	of 591 yards @	3s. 4d.	...	98	10	0
5.	of 718 yards @	5s. 0d.	...	179	10	0
6.	of 188 yards @	4s. 0d.	...	37	12	0
7.	of 853 yards @	2s. 0d.	...	85	6	0
8.	of 397 yards @	10s. 0d.	...	198	10	0
9.	of 674 yards @	1s. 0d.	...	33	14	0
10.	of 874 yards @	0s. 6d.	...	21	17	0
11.	of 274 yards @	0s. 1d.	...	1	2	10
12.	of 917 yards @	0s. 3d.	...	11	9	3
13.	of 872 yards @	0s. 1½d.	...	5	9	0
14.	of 217 yards @	0s. 4d.	...	3	12	4
15.	of 418 yards @	0s. 2d.	...	3	9	8

Find the value
16. of 714 yards @ 0s. 0¼d. ...   Ans. £0 14 10½
17. of 197 yards @ 0s. 0½d. ...   0 8 2½

CASE II. When the price is less than one shilling, but not an even part.

RULE. Divide it into several even parts, or the less into even parts of the greater, and work for each by case first, the sum of the quotients will be the answer in the name, out of which you took your first even part.

What is the price of
2	⅙	985 lb. at 2¼d.
¼	⅛	164 2
		20 6¼

2,0)18,4 8¼

£9 4 8¼ ans.

What is the price of
6	½	3587 lb. at 8½d.
2	½	1793 6
½	¼	597 10
		149 5½

2,0)254,0 9½

£127 0 9½ ans

What is the

1.	price of 5865 lb.	@	0¾d.	Ans.	£18	6	6¾
2.	price of 4719 lb.	@	1¼d.		24	11	6¾
3.	price of 8250 lb.	@	1¾d.		60	3	1½
4.	price of 3081 lb.	@	2¼d.		28	17	8¼
5.	price of 1947 lb.	@	2½d.		20	5	7½
6.	price of 7625 lb.	@	2¾d.		87	7	4¾
7.	price of 5839 lb.	@	3¼d.		79	1	4¾
8.	price of 1370 lb.	@	3½d.		19	19	7
9.	price of 8050 lb.	@	3¾d.		125	15	7½
10.	price of 3904 lb.	@	4¼d.		69	2	8
11.	price of 4162 lb.	@	4½d.		78	0	9
12.	price of 9251 lb.	@	4¾d.		183	1	10¼
13.	price of 2704 lb.	@	5d.		56	6	8
14.	ptice of 3290 lb.	@	5¼d.		71	19	4½
15.	price of 7345 lb.	@	5½d.		168	6	5½
16.	price of 1938 lb.	@	5¾d.		46	8	7½
17.	price of 6153 lb.	@	6¼d.		160	4	8¼
18.	price of 2617 lb.	@	6½d.		70	17	6½
19.	price of 8162 lb.	@	6¾d.		229	11	1½
20.	price of 3074 lb.	@	7d.		89	13	2
21.	price of 4615 lb.	@	7¼d.		139	8	2¾
22.	price of 5781 lb.	@	7½d.		180	13	1½
23.	price of 1509 lb.	@	7¾d.		48	14	6¾
24.	price of 6240 lb.	@	8d.		208	0	0

What is the

25.	price of 5900 lb.	@	8¼d.	Ans. £202 16	3
26.	price of 2635 lb.	@	8½d.	93 6	5½
27.	price of 8170 lb.	@	8¾d.	297 17	·3½
28.	price of 7452 lb.	@	9d.	279 9	0
29.	price of 3607 lb.	@	9¼d.	139 0	4¾
30.	price of 1583 lb.	@	9½d.	62 13	2½
31.	price of 9000 lb.	@	9¾d.	365 12	6
32.	price of 4111 lb.	@	10d.	171 5	10
33.	price of 5555 lb.	@	10¼d.	237 4	10¾
34.	price of 3131 lb.	@	10½d.	136 19	7½
35.	price of 7007 lb.	@	10¾d.	313 17	1¼
36.	price of 2642 lb.	@	11d.	121 1	10
37.	price of 8380 lb.	@	11¼d.	392 16	3
38.	price of 2714 lb.	@	11½d.	130 0	11
39.	price of 8888 lb.	@	11¾d.	435 2	10

Note. When the price is any number of shillings.

RULE. Multiply the given quantity by them, and divide the product by 20, for the answer in pounds.

If the price be an even number of shillings under 26, multiply the quantity by half their number, doubling the first figure of the product for shillings, the rest will be pounds.

1.	621 @	2s.	Ans. £62	2	16.	210 @ 17s.	Ans. £178	10
2.	428 @	3s.	64	4	17.	314 @ 18s.	282	12
3.	777 @	4s.	155	8	18.	639 @ 19s.	607	1
4.	882 @	5s.	220	10	19.	416 @ 20s.	416	0
5.	667 @	6s.	200	2	20.	803 @ 21s.	843	3
6.	527 @	7s.	184	9	21.	574 @ 22s.	631	8
7.	682 @	8s.	272	16	22.	635 @ 23s.	730	5
8.	400 @	9s.	180	0	23.	708 @ 24s.	849	12
9.	614 @	10s.	307	0	24.	293 @ 35s.	512	15
10.	816 @	11s.	448	16	25.	314 @ 43s.	675	2
11.	469 @	12s.	281	8	26.	520 @ 52s.	1352	0
12.	783 @	13s.	508	19	27.	472 @ 64s.	1510	8
13.	855 @	14s.	598	10	28.	795 @ 71s.	2822	5
14.	609 @	15s.	456	15	29.	348 @ 83s.	1444	4
15.	182 @	16s.	145	12	30.	231 @ 97s.	1120	7

CASE III. When the price consists of shillings and pence, which are not an even part of a pound ; or of shillings, pence, and farthings.

RULE. Multiply the quantity by the shillings, then take parts for the inferior denominations, as in cases first and second, and add them together for the answer.

What is the value of

| 6 | ½ | 473 gals. @ 2s. 9¾d. |
| | | 2 |

        946
3	½	236 6
¾	¼	118 3
		29 6¾

2,0)1330 3¾

£66 10 3¾ Ans.

What is the value of

| 2 | ⅛ | 1945 cwt. @ 17s. 2¼d. |
| | | 17 |

        13615
        1945

        33065
| ¼ | ⅛ | 324 2 |
| | | 40 6¼ |

2,0)33429 8¼

£1671 9 8¼ Ans.

What is the

						£	s	d
1.	value of 292 gals. @	1s.	1¼d.	Ans.	£16	2	5
2.	value of 671 gals. @	1s.	8¾d.		58	0	3¼
3.	value of 279 gals. @	1s.	6d.		20	18	6
4.	value of 181 gals. @	2s.	9¾d.		25	9	0¾
5.	value of 377 gals. @	3s.	10½d.		73	0	10½
6.	value of 417 gals. @	4s.	9d.		99	0	9
7.	value of 876 gals. @	4s.	11½d.		217	3	6
8.	value of 542 gals. @	5s.	7d.		151	6	2
9.	value of 822 gals. @	5s.	8¾d.		235	9	4½
10.	value of 748 gals. @	6s.	9¼d.		253	4	7
11.	value of 666 gals. @	6s.	10¾d.		229	12	7½
12.	value of 427 gals. @	7s.	2d.		153	0	2
13.	value of 380 gals. @	7s.	5½d.		141	14	2
14.	value of 421 gals. @	8s.	6¾d.		180	4	9¾
15.	value of 672 gals. @	8s.	7½d.		289	16	0
16.	value of 807 gals. @	9s.	2¼d.		370	14	3¾
17.	value of 172 gals. @	9s.	4½d.		80	12	6
18.	value of 164 gals. @	10s.	3¾d.		84	11	3
19.	value of 198 gals. @	11s.	11¼d.		118	3	7½
20.	value of 214 gals. @	12s.	9d.		136	8	6
21.	value of 278 gals. @	13s.	8d.		189	19	4
22.	value of 341 gals. @	14s.	5d.		245	16	1
23.	value of 374 gals. @	15s.	2¾d.		284	15	8½
24.	value of 669 gals. @	17s.	8d.		590	19	0
25.	value of 800 gals. @	18s.	7½d.		745	0	0
26.	value of 425 gals. @	20s.	9d.		440	18	9
27.	value of 506 gals. @	23s.	10d.		602	19	8
28.	value of 712 gals. @	24s.	8d.		878	2	8
29.	value of 360 gals. @	27s.	5d.		493	10	0
30.	value of 236 gals. @	32s.	6d.		383	10	0

Case IV. When the price consists of pounds, with some inferior money, which is an even part of a pound.

Rule. Multiply the quantity by the pounds, and by case first find the value of the inferior money; add this value and the product together, and their sum will be the answer.

What is the

1.	price of 572 cwt.	@	£3	3	4	Ans. £1811	6	8
2.	price of 488 cwt.	@	6	2	6	2989	0	0
3.	price of 375 cwt.	@	10	5	0	3843 15	0
4.	price of 176 cwt.	@	7	6	8	1290 13	4
5.	price of 515 cwt.	@	16	1	8	8282 18	4
6.	price of 917 cwt.	@	4	4	0	3851 8	0
7.	price of 470 cwt.	@	8	10	0	3995 0	0
8.	price of 255 cwt.	@	5	1	0	1287 15	0
9.	price of 608 cwt.	@	3	2	0	1884 16	0
10.	price of 341 cwt.	@	9	3	4	3125 16	8
11.	price of 190 cwt.	@	1	6	8	253 6	8
12.	price of 412 cwt.	@	6	2	6	2523 10	0

Note 1. When the inferior money is not an aliquot part of a pound.

Rule. Multiply by the pounds, and take parts for the inferior money; or multiply by the number of shillings in the price, and take parts for the rest.

N. B. Sometimes the one way is easier—sometimes the other; this depends upon the price: but it is a very good exercise for the pupils to work the questions both ways.

What is the price of

```
3 4 | 1/6 | 857 cwt. @ £4 3s. 8½d.
              4

            3428
    4 | 1/10 | 142 16 8
    ½ | 1/6 |  14  5 8
      .  .  |   1 15 8½

        £3586 18 0½ Ans.
```

or thus,

```
6 | ½ |   857 @ £4 3s. 8½d.
            83

          2571
          6856

          71131
2 | ⅓ |   428  6
½ | ¼ |   142 10
           35  8½

      20)71738  0½

        £3586 18 0½
```

Find the

1.	price of 478 cwt.	@	£3	11	8½	Ans. £1713 16	7
2.	price of 866 cwt.	@	6	2	11½	5324 1	11
3.	price of 648 cwt.	@	2	17	6	1863 0	0

Find the

			£	s	d			£	s	d
4.	price of 254 cwt.	@	5	8	3¾	Ans.	£1375	11	4½
5.	price of 421 cwt.	@	20	0	9¼		8436	4	6¼
6.	price of 611 cwt.	@	5	1	4½		3097	0	1½
7.	price of 189 cwt.	@	3	14	7½		705	4	1½
8.	price of 210 cwt.	@	5	16	3¾		1221	5	7½
9.	price of 607 cwt.	@	10	0	9¼		6093	7	10¾
10.	price of 514 cwt.	@	2	18	3		1497	0	6
11.	price of 214 cwt.	@	1	14	6		369	3	0
12.	price of 666 cwt.	@	7	0	10		4689	15	0
13.	price of 750 cwt.	@	4	13	10½		3520	6	3
14.	price of 342 cwt.	@	2	9	8		849	6	0
15.	price of 196 cwt.	@	11	5	6		2209	18	0
16.	price of 400 cwt.	@	8	16	7½		3532	10	0
17.	price of 965 cwt.	@	3	8	11		3325	4	7
18.	price of 508 cwt.	@	1	19	4¾		1000	13	1
19.	price of 254 cwt.	@	15	10	10		3947	11	8
20.	price of 621 cwt.	@	4	17	6		3027	7	6

Note 2. When there is a fraction in the quantity.

RULE. Find the value of the whole number by the foregoing rules, and the value of the fraction as in compound multiplication with a fraction.

				£	s	d			£	s	d	
1.	275⅝	yards	@	£0	6	8	Ans.	£91	17	6	
2.	721⅘	yards	@	0	18	0		649	12	4½	⅕
3.	419 2/9	yards	@	0	5	11		124	0	4½	1/9
4.	580½	yards	@	1	5	6		740	2	9	
5.	194¼	yards	@	0	17	8		171	11	9	
6.	426⅚	yards	@	1	3	9		506	17	3½	
7.	812¾	yards	@	0	19	4		785	13	2	
8.	105⅞	gals.	@	0	8	2		43	0	6¾	
9.	147¾	gals.	@	0	7	3		53	11	2¼	
10.	163⅝	gals.	@	0	1	4		10	18	2	
11.	158½	gals.	@	0	6	9		53	9	10½	
12.	215 7/10	gals.	@	0	2	11		31	9	1½	
13.	142 6/16	gals.	@	0	3	10		27	6	5¾	
14.	166⅔	gals.	@	0	3	9½		31	9	10½	
15.	809¼	gals.	@	2	8	4		1955	13	9	
16.	570 5/12	cwt.	@	3	18	0		2224	12	6	
17.	416¼	cwt.	@	1	12	6		676	8	1½	
18.	284 3/10	cwt.	@	4	10	0		1279	7	0	
19.	705 9/15	cwt.	@	0	19	10		699	13	0¾	11/15
20.	612½	cwt.	@	5	8	4		3317	14	2	
21.	365⅞	cwt.	@	1	15	8		651	11	8½	

CASE V. *When the quantity consists of several denominations.*

RULE. Multiply the price by the number of integers; and for the other denominations of the quantity, take parts of the price of the integer; or of one another, and add them to the value of the integral part for the answer.

Note. To know which are the integers, observe, when the price is at so much per cwt., the cwts. in the quantity are integers; when at so much per yard, the yards are integers; when at so much per ounce, the ounces are integers, &c.

27yd. 1qr. 2na. at 15s. 8d. per yd. | 63gl. 2qt. 1pt. at 8s. 4d. per gl.

1	¼	15s. 8d.			2	½	8s. 4d.	
		3					9	
		2 7 0					3 15 0	
		9					7	
		21 3 0					26 5 0	
2	½	3 11			1	¼	0 4 2	
		1 11½					0 1 0½	

£21 8 10½ Ans.   £26 10 2½ Ans.

1. 35 yds. 2 qrs. 1 na. @ 5s. 6d. per yard £9 15 7 ½
2. 14   2   0   @ 16s. 9d.   12 2 10½
3. 97   1   3   @ 7s. 8d.   37 7 0¼
4. 52   0   2   @ 2s. 6½d.   6 12 5¾ ¼
5. 475   3   1   @ 4s. 9d.   113 0 1¼ ¼
6. 740   2   2   @ 12s. 6d.   462 17 9¾
7. 318   1   3   @ 15s. 8d.   249 8 10¼
8. 43 gal. 2 qt. 1 pt. @ 3s. 6d. per gal. 7 12 8¼
9. 56   1   1   @ 4s. 3d.   11 19 7 ½
10. 97   3   0   @ 11s. 8d.   57 0 5
11. 814   2   1   @ 2s. 9d.   112 0 2½ ½
12. 570   1   1   @ 5s. 3d.   149 14 5½ ½
13. 408   3   0   @ 12s. 6d.   255 9 4½
14. 36 qrs. 4bus. 2 pec. @ 16s. 4d. per qr. 29 17 2¼
15. 85   3   1   @ 13s. 8d.   58 7 2½ ½
16. 370   5   3   @ 25s. 6d.   472 13 3¾ ¾
17. 406   2   2   @ 38s. 0d.   771 19 10½
18. 512   7   1   @ 17s. 9d.   455 4 1 ½
19. 36 oz. 15dwt. 8 gr. @ 5s. 4d. per oz. 9 16 1 ⁴⁄₁₅
20. 75   12   0   @ 4s. 8d.   17 12 9½ ⅖
21. 192   15   10   @ 6s. 6d.   62 13 0 ¼
22. 318   17   12   @ 7s. 3d.   115 11 10 ½

23.	450 oz.	10dwt. 0 gr.	@	5s. 10d. per oz.	£131	7	11	
24.	64 cwt.	1 qr. 16 lb.	@	7s. 4d.	23	12	2½	⅞
25.	18	0 14	@	17s. 6½d.	15	17	11¼	¼
26.	72	1 16	@	1s. 8d.	6	0	7¾	⅗
27.	142	3 0	@	15s. 9d.	112	8	3¾	
28.	504	2 24	@	16s. 4d.	412	3	8	
29.	189	2 7	@	5s. 10d.	55	5	9¼	½
30.	610	1 21	@	24s. 6d.	747	15	8½	½
31.	217	2 10½	@	19s. 0d.	206	14	3¼	½

Note. When the given quantity is not of the same name with the integer whose price is given.

RULE. Reduce it to the same name; then find its value by the foregoing rules.

6 cwt. of sugar @ 8½d. per lb. | 8 doz. prs gloves @ 3s. 9d. per pr.

```
112  | 6  ½ | 672        12              3  9
                                         12
672 lbs.| 2  ⅓ | 336      96 pairs.     -----
        | ½  ¼ | 112                  2  5  0
              |    28                       8

        20)476                    £18  0  0 Ans.

        £23 16 Ans.
```

1.	7 cwt. sugar	@	0s. 9¾d.	per lb.	£31	17	0
2.	14 cwt. flax	@	12s. 0d.	per stone	67	4	0
3.	6½ tons tallow	@	7s. 4d.		381	6	8
4.	9 cwt. beef............	@	7s. 4d.		26	8	0
5.	17 hhds. wine	@	16s. 2d.	per gal.	865	14	6
6.	20 anks. brandy	@	22s. 0d.		220	0	0
7.	6 puns. rum	@	16s. 0d.		403	4	0
8.	60 lb. tea	@	0s. 7½d.	per oz.	30	0	0
9.	17 stones soap	@	0s. 9d.	per lb.	8	18	6
10.	19 gallons gin	@	5s. 6d.	per qt.	20	18	0
11.	7 thousand quills ...	@	2s. 9d.	per hund.	9	12	6
12.	21 reams paper	@	1s. 3d.	per quire	26	5	0
13.	16 pounds cloves......	@	1s. 3d.	per oz.	16	0	0
14.	27 doz. lb. candles ...	@	0s. 9½d.	per lb.	12	16	6
15.	19 stones leather......	@	1s. 10½d.		24	18	9
16.	8 doz. pairs gloves...	@	1s. 5d.	per pair	6	16	0
17.	3 cwt. tea	@	5s. 0d.	per lb.	84	0	0
18.	44 yards cloth	@	6s. 10½d.	per ell Eng.	12	2	0
19.	96 ells English........	@	14s. 9d.	per yard	88	10	0
20.	37 yds. 3 qrs.	@	12s. 6d.	per ell Flem.	31	9	2
21	59 cwt. 1 qr. 14 lb. ...	@	14s. 6d.	per stone	344	7	6

22. 18 acres 3 roods ...... @ 78s. 0d. per rood £292 10 0
23. 16 lb. 7 oz. troy ...... @ 5s. 8d. per oz.   56 7 8

COMMERCIAL ALLOWANCES; or, TARE AND TRET,

Are certain deductions made from goods which are weighed in the chest, barrel, or whatever contains them.

Gross weight is the weight of both goods and packages.

Tare is an allowance granted to the buyer for the weight of the barrel, &c., containing the goods, and is deducted from the gross weight.

Tret is an allowance of 4 lb. on 104 lb., or $\frac{1}{26}$ on goods liable to waste, and is deducted after the tare.

Cloff is an allowance of 2 lb. on 3 cwt., or $\frac{1}{168}$ given to retailers for the turn of the scale, and is deducted after the tret.

Note. After subtracting the tare from the gross weight, the remainder is called *tare suttle;* and after subtracting the tret, the remainder is called *tret suttle;* and what remains after all the deductions are made, is called *net weight.*

RULE. Subtract the tare from the gross weight, and from the tare suttle deduct $\frac{1}{26}$ part, the remainder will be the tret suttle; and from the tret suttle deduct $\frac{1}{168}$ part, the remainder is the net weight.

Note. In calculating commercial allowances, remainders less than $\frac{1}{2}$ a lb. are rejected, but when $\frac{1}{2}$ or more they are considered as 1 lb.

What is the net weight of 6786 cwt. 2 qr., tare 18 lb. per cwt., deducting also tret and cloff?

<pre>
              cwt. qr. lb.
  16 | ⅐ | 6786   2   0 gross weight.

   2 | ⅛ | 969   2   0
            121   0 21
          ─────────────
           1090   2 21 tare.
          ─────────────
      26)5695   3   7 tare suttle.
          219   0   8 tret.
        ─────────────
    168)5476   2 27 tret suttle.
         32   2 11 cloff.
       ─────────────
  Ans. 5444   0 16 net weight.
</pre>

1. Find the net weight of 20 barrels figs, each 3 cwt. 3 qrs. 18 lb., tare 36 lb. per bar., also deducting tret and cloff.
                                                    Ans. 68 cwt. 2 qrs. 13 lb.

2. What is the net weight of 5 casks sugar, each 13 cwt. 0 qrs. 13 lb., tare 12 lb. per cwt., deducting also tret and cloff?
                                                    Ans. 55 cwt., 3 qrs. 24 lb.

3. What is the net weight of 4 chests of tea, each 2 cwt. 1 qr. 24 lb., tare 24 lb. per chest, deducting also tret and cloff?
                                                    Ans. 8 cwt. 2 qrs. 11 lb.

Note. Tret and cloff are now generally discontinued; but an allowance called *Draft* is given on some commodities to retailers to make the weight hold out. Draft is at so much per cask, per bag, &c., and is deducted before the tare.

What is the net weight of 7 bags cotton wool, weighing 14 cwt. 1 qr. 11 lb., draft 1 lb. per bag, tare 2½ lb. per 100 lb.?

$$
\begin{array}{rrrl}
 & \text{cwt.} & \text{qr.} & \text{lb.} \\
 & 14 & 1 & 11 \text{ gross.} \\
 & & & 7 \text{ draft.} \\
\hline
2\tfrac{1}{2} \text{ lb. per } 100 = \mid \tfrac{1}{40} \mid & 14 & 1 & 4 \\
 & 0 & 1 & 12 \text{ tare.} \\
\hline
\text{Ans.} \quad 13 & 3 & 20 \text{ net.}
\end{array}
$$

4. Find the value of 6 chests of congou, weighing 6 cwt. 1 qr. 3 lb., deducting draft 1 lb. and tare 25lb. per chest, at 3s. 4d. per lb.   *Ans.* £91 3s. 4d.

5. Find the value of 4 chests of souchong, weighing 3 cwt. 1 qr. 20 lb., draft 1 lb. and tare 23 lb. per chest, at 4s. 6d. per lb.
                                                    Ans. £64 16s.

6. Find the net weight and value of 5 bags cotton wool, weighing 12 cwt. 2 qr. 8 lb., deducting draft 1 lb. per bag, and tare 2½ lb. per 100 lb., at 2s. 1d. per lb.
                                          Ans. 1368 lb.   £142 10s.

7. What is the net weight of 36 bags of cotton wool, each containing 2 cwt. 3 qrs. 5lb. gross, and allowing draft at 1 lb. per bag, tare at 2½ per 100 lb.; and what is the value of it at 1s. 9d. per lb. net?   *Ans.* 10951 lb.   £958 4s. 3d.

8. How many gallons net are in 14 casks oil, each weighing 3 cwt. 2 qrs. gross, allowing tare at 15 lb. per cwt. and 7½ lb. to the gallon?   *Ans.* 633$\frac{11}{15}$ gallons.

9. What is the net weight of 468 cwt. 3 qrs. 16 lb. sugar, after deducting tare at 14 lb. per cwt.?
                                          Ans. 410 cwt. 1 qr. 3½ lb.

10. What is the net weight of 315 cwt. 2 qr. 21 lb., tare 16 lb. per cwt.?   *Ans.* 270 cwt. 2 qrs. 10 lb.

11. What is the net weight of 37 bags coffee, each 4 cwt. 18 lb., after deducting tare at 13 lb. per cwt.?

Ans. 136 cwt. 0 qr. 8 lb.

SIMPLE INTEREST.

Interest is the allowance given by the borrower to the lender for the use of his money.

Principal is the money lent.

Interest is the rate per cent. agreed upon.

Amount is the *sum* of principal and interest.

Note. The highest interest which the law allows is called *legal interest. Usury* is interest above what the law allows.

1. To find the interest of any sum of money for any number of years.

Rule. Multiply the principal by the number of years and by the rate per cent. and divide the product by 100.

What is the interest and amount of £746 15s. 6¼d. for 3½ years at 6 per cent.

```
      £    s.   d.
     746  15   6¼
                6
    ────────────────
     4480  13   3
                3½
    ────────────────
    13441  19   9
     2240   6   7½              £    s.   d.
    ────────────────          746  15   6¼  principal.
 156)82    6   4½             156  16   5½  interest.
      20                      ───────────────
    ─────                     903  12   0   amount.
   16)46
      12
    ─────
    5)56
      4
    ─────
    2)26  13
    ──────═──
     100   50
```

1. Required the interest of £3748 16s. for two years, at 5 per cent.   *Ans.* £374 17s. 7½d.

2. What is the interest of £754 14s. 8¾d. for one year, at 4 per cent.? *Ans.* £30 3s. 9¼d. $\frac{22}{2\frac{1}{5}}$

3. Find the interest of £824 16s. 4d. for 3 years, at 4¼ per cent. *Ans.* £105 3s. 3¼d. $\frac{14}{25}$

4. Find the interest of £1090 10s. 6d. for 4¼ years at 5½ per cent. *Ans.* £254 18s. 2¼d. $\frac{81}{100}$

5. What is the interest of £450, for 5 years, at 6 per cent.?
Ans. £135.

6. What is the interest of £132 15s. for 2 years, at 4¾ per cent.? *Ans.* £12 12s. 2½d. $\frac{4}{5}$

7. Required the interest of £75 10s. for 5 years, at 5½ per cent. *Ans.* £20 15s. 3d.

8. What is the interest of £400, for 2 years and 5 months, (or 2$\frac{5}{12}$ years) at 4 per cent.? *Ans.* £38 13s. 4d.

9. What is the interest of £250, for 3 years 7 months (or 3$\frac{7}{12}$ years) at 6 per cent.? *Ans.* £53 15s.

10. What is the interest of £680, for 4 years 10 months (i. e. 4$\frac{5}{6}$ year) at 5 per cent.? *Ans.* £164 6s. 8d.

11. What is the interest of £740, for 1 year 3 months, at 4½ per cent.? *Ans.* £41 12s. 6d.

12. What is the interest of £320, for 2 years 9 months, at 6 per cent.? *Ans.* £52 16s.

13. Find the interest of £1000, for 5 years 11 months, at 5½ per cent. *Ans.* £325 8s. 4d.

14. Find the interest of £65 15s. for 3 years 8 months, at 6 per cent. *Ans.* £14 9s. 3½d. $\frac{2}{5}$

15. Find the interest of £4500 for 4 years 2 months, at 5 per cent. *Ans.* £937 10s.

16. Find the interest of £50, for 5 months, at 6 per cent.
Ans. £1 5s.

17. Find the interest of £160, for 7 months, at 4½ per cent. *Ans.* £4 4s.

18. Find the interest of £360, for 10 months, at 5½ per cent. *Ans.* £16 10s.

II. To find the interest for weeks.

RULE. Multiply the principal by the rate per cent. and by the number of weeks, and divide the product by 5200.

1. Find the interest of £852 10s. for 40 weeks, at 6 per cent. *Ans.* £39 6s. 11d. $\frac{1}{13}$

2. What is the interest of £653 2s. 7d. for 36 weeks, at 5 per cent.? *Ans.* £22 12s. 1¾d. $\frac{64}{65}$

3. Required the interest of £428 4s. 10d. for 47 weeks, at 4 per cent. *Ans.* £15 9s. 7¾. $\frac{7}{25}$

4. Required the interest of £200 19s. 9d. for a year and 14 weeks, at 3 per cent.   *Ans.* £7 13s. 0¼d. $\frac{563}{650}$

5. Required the amount of £120, for 2 years and 18 weeks, at 3½ per cent.   *Ans.* £129 17s. 0¼d. $\frac{9}{13}$

6. Required the amount of £106, for 1 year and 6 weeks, at 5 per cent.   *Ans.* £111 18s. 2¾d. $\frac{1}{13}$

III. To find the interest for days.

RULE. Multiply the principal by the rate per cent. and by the number of days, and divide the product by 36,500.

1. What is the interest of £743 12s. 4d. for 142 days, at 4½ per cent.?   *Ans.* £13 0s. 4½d. $\frac{5927}{9125}$

2. What is the interest of £780 14s. 9½d. for 36 days, at 4 per cent.?   *Ans.* £3 1s. 7d. $\frac{1772}{1825}$

3. What is the interest of £780, for 257 days, at 3¾ per cent.?   *Ans.* £20 11s. 10¾d. $\frac{39}{73}$

4. What is the interest of £584, for 308 days, at 3⅝ per cent.?   *Ans.* £16 12s. 7½d. $\frac{1314}{1825}$

5. What is the interest of £850, for 308 days, at 4½ per cent.?   *Ans.* £32 5s. 6¼d. $\frac{47}{73}$

6. Find the interest of £145 13s. 8d. from 4th of June to the 16th October, at 6 per cent.   *Ans.* £3 4s. 2d. $\frac{1514}{9125}$

7. Find the interest of £362 15s. 9d. from 6th May to 8th September, at 4 per cent   *Ans.* £4 19s. 4½d. $\frac{66}{73}$

8. Find the interest of £724 18s. from 3rd January till August 20th, at 5 per cent.   *Ans.* £22 14s. 9½d. $\frac{754}{1825}$

9. Find the interest of £230, from May 24th till November 16th, at 3 $\frac{5}{12}$ per cent.   *Ans.* £3 15s. 9¼d. $\frac{239}{365}$

10. Find the interest of £154, from January 7th till July 23rd, at 4⅝ per cent.   *Ans.* £3 16s. 10½d. $\frac{726}{1825}$

11. Find the interest of £630, from September 12th till January 27th, at 4¼ per cent.   *Ans.* £10 0s. 11¾d. $\frac{293}{365}$

12. Find the interest of £720, from March 8th till June 7th, at 6 per cent.   *Ans.* £10 15s. 4¾d. $\frac{217}{365}$

IV. To find the interest when partial payments are made.

RULE. Multiply the principal and the successive balances by the number of days between the times of payments, add the products and find the interest as formerly.

Borrowed March 20th, 1845, £1000; of which I paid £300 September 17th, £150 December 21st, £220 February 23rd, 1846, and the balance July 23rd: how much then was due, principal and interest, at 4 per cent.?

	£		days.
Mar. 20	1000	181	181000
Sept. 17	300		
	700	95	66500
Dec. 21	150		
	550	64	35200
Feb. 23	220		
	330	150	49500
July 23	330		
			332200
			4

July 23rd, 1846.
Principal due £330   0   0
Interest due   36   8   1¼

Ans. £366   8   1¼

$£$ $s.$ $d.$
36500) 1328800 (36   8   1¼ $\frac{19}{73}$ Interest.

1. Required the interest on a bill of £854, due June 8th, of which £240 were paid August 16th, £169 October 4th, £238 January 20th, and the balance March 8th, at 4 per cent.
Ans. £16 1s. 9d. $\frac{123}{1825}$

2. Required the interest on a bond of £1000, due March 16th, of which £324 were paid May 3rd, £166 July 18th, £102 December 2nd, and the balance January 6th, at 4½ per cent. Ans. £22 12s. 6¼d. $\frac{791}{1825}$

3. What is the interest on a bill of £456, due May 7th, of which £120 were paid June 18th, £116 September 27th, £136 November 17th, and the balance December 27th, at 4½ per cent.? Ans. £8 6s. 10d. $\frac{1688}{1825}$

4. What is the interest on a bill of £900, due January 1st, of which £150 were paid February 28th, £270 March 30th, £173 June 19th, £213 July 28th, £57 September 23rd, and the balance November 17th, at 3¾ per cent.? Ans. £13 13s. 2d. $\frac{176}{365}$

5. Lent January 20, 1845, £2000; of which I received April 7, £350; September 28, £690; December 18, £420; and the balance April 7: how much was then due, principal and interest, at 4½ per cent. Ans. £608 13s. 0¼d. $\frac{291}{365}$

V. To find the interest on accounts current.

RULE. Add and subtract the sums paid and received in the order of their dates. Find the number of days between the different transactions, multiply them into their respective balances; and if the balances are sometimes due to the one party and sometimes to the other, extend the products in different columns, then add them; and when the rates of interest are different, multiply each sum by its rate, and divide the difference of the products by 36,500 for the interest.

Required the interest on the following account, till November 30, allowing 5 per cent. to A. B. and 4 per cent. to R. S.

Dr.	A. B.'s account current with R. S.			Cr
Dec. 7. To balance £103		March 13.	By cash	£354
Feb. 13. To cash 118		June 3.	...	275
April 28. ... 400		Aug. 17.	...	100
Sept. 5. ... 350		Nov. 18.	...	255

Dec. 7.	Dr.	103	68	7004		
Feb. 13.	Dr.	118				
	Dr.	221	28	6188		
Mar. 13.	Cr.	354				
	Cr.	133	46		6118	
Apr. 28.	Dr.	400				
	Dr.	267	36	9612		
June 3.	Cr.	275				
	Cr.	8	75		600	
Aug. 17.	Cr.	100				
	Cr.	108	19		2052	
Sept. 5.	Dr.	350				
	Dr.	242	74	17908		
Nov. 18.	Cr.	255				
Nov. 30.	Cr.	13	12		156	

$$
\begin{array}{ll}
40712 & 8926 \\
4 & 5 \\
\hline
162848 & 44630 \\
44630 & \\
\hline
36500)118218 &
\end{array}
$$

£ s. d.
3   4   9¼ $\frac{539}{1825}$

1. Required the interest on the following account, at 5 per cent.

Dr.	Mr. Syme's account current with W. F. & Co.			Cr.
Jan. 7. To balance £210		April 14.	By cash	£130
Mar. 7. To cash 150		June 27.	...	215
May 8. ... 240		Aug. 13.	...	167
July 21. ... 300		Oct. 12.	...	280
Sept. 18. ... 250		Nov. 18.	...	120
Dec. 24. ... 160				

Ans. £17 2s. 7¼ $\frac{157}{365}$

2. Required the interest on the following account, at 4 per cent.

Dr. S. M. & Co.'s account current with N. P. Cr.

May 1.	To balance	£250	June 8.	By cash	£124
June 28.	To cash	140	July 19.	...	230
Aug. 11.	...	340	Oct. 20.	...	150
Nov. 12.	...	221	Dec. 12.	...	200

Ans. £6 18s. 10$\frac{1}{2}$d. $\frac{54}{1825}$.

3. Required the interest on the following account, till December 31st, allowing 5 per cent. when the balance is due to the bank, and 3$\frac{1}{2}$ per cent. when due to A. B.

A. B.'s account current with the Commercial Bank.

Drawn on the Bank by A. B. Paid to the Bank by A. B.

Dr.			Cr.		
Feb. 24.	To cash	£826	Mar. 18.	By cash	£300
May 8.	...	131	June 28.	...	727
Aug. 15.	...	400	Sept. 6.	...	564
Sept. 27.	...	248	Oct. 21.	...	322
Nov. 2.	...	408	Dec. 10.	...	68

Ans. £12 10s. 2$\frac{3}{4}$d. $\frac{17}{365}$

4. On the following, till December 31st, 5 per cent. to the bank, 4 per cent. to C. D.

C. D.'s account current with the Montreal Bank.

Drawn on the Bank by C. D. Paid to the Bank by C. D.

Dr.			Cr.		
March 2.	To cash	£428	April 16.	By cash	£355
Mar. 29.	...	500	June 8.	...	839
May 4.	...	118	July 25.	...	456
Aug. 7.	...	800	Oct. 13.	...	422
Aug. 28.	...	169	Nov. 26.	...	166

Ans. £8 14s. 1$\frac{3}{4}$d. $\frac{1193}{1825}$

COMPOUND INTEREST.

Compound Interest is an allowance not only for the use of the sum borrowed, but also for the use of the interest after it becomes due, which is added to the principal, and the amount becomes a new principal for the next year.

RULE. Find the interest for the first year, and add it to the principal, then find the interest of the sum for the second year, and add it to that sum, and so on.

Note. When the rate of interest is at 5 per cent. the $\frac{1}{20}$ part of any sum is its interest for one year.

What will £1000 amount to in four years, at 5 per cent. per annum?

		£	s.	d.	
5	$\frac{1}{20}$	1000	0	0	given principal.
		50	0	0	first year's interest.
5	$\frac{1}{20}$	1050	0	0	second year's principal.
		52	10	0	second year's interest.
5	$\frac{1}{20}$	1102	10	0	third year's principal.
		55	2	6	third year's interest.
5	$\frac{1}{20}$	1157	12	6	fourth year's principal.
		57	17	7$\frac{1}{2}$	fourth year's interest.
		1215	10	1$\frac{1}{2}$	amount in 4 years.
		1000	0	0	
		215	10	1$\frac{1}{2}$	compound interest.

1. What will £4000 amount to in 6 years, at 5 per cent. per annum?   *Ans.* £5360 7s. 7$\frac{3}{4}$d.

2. What will £20,000 amount to in 8 years, at 5 per cent. per annum?   *Ans.* £29,549 2s. 1$\frac{1}{4}$d.

3. What will £100 amount to in 10 years, at 7$\frac{1}{2}$ per cent.?
                                    Ans. £206 1s. 11$\frac{1}{2}$d.

COMMISSION AND BROKERAGE.

Commission and *Brokerage* are allowances of a certain rate per cent. to bankers, agents, or brokers, for transacting the business of others.

Rule I. When the rate per cent. is £1 or upwards, multiply the sum by the rate per cent. and divide by 100 as in interest.

Rule II. When the rate is under £1, work the question by proportion, or take parts as in Practice,—and divide by 100.

According to Dr. Price's calculation, "one penny put out at our Saviour's birth, at 5 per cent. *compound interest*, would, in the year 1791, have increased to a greater sum than would be contained in three hundred millions of earths, all of solid gold! But if put out at *simple interest* it would, in the same time, have amounted to no more than 7s. 5$\frac{1}{2}$d. $\frac{1}{5}$." That the latter is correct, any person may satisfy himself in two minutes, but the former involves a calculation of such length as few will encounter.

What is the commission on £937, at 7s. 6d. (or $\frac{3}{8}$) per cent.?

s.	d.		£	s.	d.	
5	0	$\frac{1}{4}$	937	0	0	or, 100 : 937 :: 7 6 : 3 10 3$\frac{1}{4}$ $\frac{1}{5}$
2	6	$\frac{1}{2}$	234	5	0	
			117	2	6	or, £937 × $\frac{3}{8}$ ÷ 100 = £3 10 3$\frac{1}{4}$ $\frac{1}{5}$

100)351 7 6

Ans.   £3 10 3$\frac{1}{4}$ $\frac{1}{5}$

1. What is the commission on £831 6s. at 2$\frac{1}{2}$ per cent.?
    Ans. £20 15s. 7$\frac{3}{4}$d. $\frac{1}{5}$
2. What is the commission on £759 10s. 5d. at $\frac{3}{4}$ per cent.?
    Ans. £5 13s. 11d. $\frac{11}{20}$
3. What is the commission on £568 14s. 9d. at 1$\frac{1}{4}$ per cent.?
    Ans. £7 2s. 2d. $\frac{17}{20}$
4. What is the commission on £950 10s. at 1$\frac{3}{4}$ per cent.?
    Ans. £16 12s. 8d. $\frac{2}{5}$
5. What is the commission on £576 15s. at 2$\frac{1}{2}$ per cent.?
    Ans. £14 8s. 4$\frac{1}{2}$d.
6. What is the commission on £958 16s. 6d. at 3$\frac{1}{3}$ per cent.?
    Ans. £31 19s. 2$\frac{1}{2}$d. $\frac{2}{5}$
7. What is the commission on £1242, at 2s. 6d. per cent.?
    Ans. £1 11s. 0$\frac{1}{4}$d. $\frac{2}{5}$
8. What is the commission on £573, at 6s. 8d. per cent.?
    Ans. £1 18s. 2$\frac{1}{4}$d. $\frac{3}{5}$
9. What is the brokerage on £756 19s. 8$\frac{1}{4}$d. at $\frac{5}{8}$ per cent.?
    Ans £4 14s. 7$\frac{1}{4}$d.
10. What is the brokerage on £1219 15s. 6d. at 4s. per cent.?
    Ans. £2 8s. 9$\frac{1}{4}$d.
11. What is the brokerage on £675, at 2s. 9d. per cent.?
    Ans. 18s. 6$\frac{3}{4}$d.
12. What is the brokerage on £598, at 4s. 6d. per cent.?
    Ans. £1 6s. 10$\frac{3}{4}$d. $\frac{17}{25}$
13. How much does a broker receive for selling stock to the amount of $\frac{1}{2}$ a million, at 2s. 6d. per cent.?   *Ans.* £625.
14. My agent writes me that he has transacted business on my account to the amount of £8560 : to what commission is he entitled at 2$\frac{1}{3}$ per cent.?   *Ans.* £199 14s. 8d.
15. A salesman disposes of woollen goods to the amount of £1260, muslins to £1450, and hardware to £850 : what is his commission at 2$\frac{1}{2}$ per cent.?   *Ans.* £75 13s.
16. My factor's sales, per the ship Silas, amount to £917 14s. 11d.; what is his commission, at 2$\frac{1}{4}$ per cent.?
    Ans. £20 12s. 11$\frac{3}{4}$d. $\frac{31}{100}$

17. When a factor is allowed 10s. per cent. for commission, what should he charge for transacting business to the amount of £6800?　　　　　　　　　　　　　　　*Ans.* £34.

18. Sent my employer an account of the sales of 40 hhds. sugar, the gross amount came to £2200; duty, freight, and other charges, £754 14s. 8d. ; commission on the gross amount 2¼ per cent.: required the amount of the net proceeds.
　　　　　　　　Ans. £49 10s. com.; £1395 15s. 4d. net pro.

19. Purchased goods for my employer, to the amount of £654 14s. 8d. and sent them according to his order ; packing, cartage and porterage, £4 3s. 8d.; commission on the sum laid out, 2¾ per cent.: required the amount of the invoice.
　　Ans. £18 2s. 4¾d. ⅔ com.; £677 0s. 8¾d. ⅔ am. of in.

INSURANCE.

INSURANCE is a contract by which the insurer engages to repay losses sustained by the insured, for a certain per centage on the sum insured.

The *insurer* is the party who undertakes the risk.

The *insured* is the party protected by the insurance.

Premium is the sum paid to the insurer.

Policy is the paper or parchment containing the contract of insurance.

I. To find the premium.

RULE. Calculate as in commission and brokerage.

1. What is the premium on £1674 10s. at 2s. 3d. per cent.?
　　　　　　　　　　　　　Ans. £1 17s. 8d. $\frac{23}{50}$

2. What is the premium on £579 12s. at 3s. 9d per cent.?
　　　　　　　　　　　　　Ans. £1 1s. 8¾d. $\frac{7}{25}$

3. What is the annual expense of insuring a house and furniture to the amount of £1570, at 5s. 6d. per cent.?
　　　　　　　　　　　　　Ans. £4 6s. 4d. ⅕

4. What is the premium of insurance on a spinning mill, valued at £3500, at 7s. 6d. per cent.?　　　*Ans.* £13 2s. 6d.

5. What is the expense of insuring a ship and cargo, value £7830, at £3⅗ per cent.?　　　　　　*Ans.* £283 16s. 9d.

6. What is the premium on £35970, insured on a ship and cargo, from Glasgow to Montreal, at 9⅜ per cent.?
　　　　　　　　　　　　　Ans. £3372 3s. 9d.

BUYING AND SELLING STOCKS.

Stock is the capital of a bank or trading company; or it is the debt owing by government, called the public funds.

Case I. To find the value of any quantity of stock.

Rule. Multiply by the rate, and divide by 100.

1. Required the value of £1260, three per cent. consols, at 87⅝ per cent.   *Ans.* £1104 1s. 6d.

2. Required the value of £860, four per cent. government stock, at 78¼ per cent.   *Ans.* £672 19s.

3. What is the price of £1640 India stock, at 230 per cent.?   *Ans.* £3772.

4. What is the price of £3420 bank stock, at 172 per cent.?   *Ans.* £5882 8s.

Note. Stock is bought and sold through the medium of brokers, who receive ⅛ per cent. for every quantity of stock which they buy or sell. Brokerage is omitted in the foregoing questions, but included in the following:

5. Bought £3000 stock in the 3 per cent. cons, when at 63, and sold out when at 67⅝: what did I gain? *Ans.* £131 5s.

6. Bought £6000 stock in the 3 per cent. red. when at 62⅞, and sold out when at 61¼: how much did I lose?
     Ans. £112 10s.

Case II. To find how much stock may be bought for a given sum.

Rule. Increase the given rate by ⅛; then, as that sum is to the given purchase money, so is £100 to the quantity of stock.

How much stock at 65⅝ will £4734 purchase?

$$65\tfrac{3}{4} : 4734 : : 100 : \text{£}7200 \text{ ans.}$$

7. How much stock at 84¾ will £6178 18s. purchase?
     Ans. £7280.

8. How much stock may be purchased for £1638, at 68⅜ per cent.?   *Ans.* £2400.

9. How much stock, at 100¼, will £1606 purchase?
     Ans. £1600.

10. How much stock in the 3 per cent. reduced annuities may be bought for £1100, when the price is at 68⅝?
     Ans. £1600.

Case III. To find the rate of interest arising from money in the stocks.

Rule. As the price of any kind of stock is to £100, so is the dividend on £100 of that kind of stock to the rate of interest arising from money invested in it.

What rate of interest arises from money vested in the 3 per cent. consols, when the price is at 67⅝?

$$67\tfrac{5}{8} : 100 : : 3 : \text{£}4 \text{ 8s. } 8\tfrac{1}{2}\text{d. per cent.}$$

11. What rate of interest arises from money in the 4 per cent. consols, when the price is 95?   *Ans.* £4 4s. 2¼d. $\frac{9}{19}$

12. What rate of interest arises from money vested in the 3 per cent. cons. when the price is at 57? *Ans.* £5 5s. 3d. $\frac{3}{19}$

13. What rate of interest arises from money vested in India stock, when the price is at 225; the dividends being 10½ per cent. ?   *Ans.* £4 13s. 4d.

14. What rate of interest arises from money vested in bank stock, when the price is 218; the dividends being 10 per cent.?
                       Ans. £4 11s. 8¾d. $\frac{73}{100}$

DISCOUNT.

Discount is the allowance that ought to be made for receiving payment of a sum of money before it is due.

The *present value* of a sum of money due at a future period, is such a sum as, if lent on interest for that period, at the rate proposed, would amount to the sum then due.

I.   True method of finding the discount.

RULE.   As the amount of £100 for the given rate and time, is to the interest of £100 for the same time, so is the given debt to the discount; which, subtracted from the debt, leaves the present value.   Or,

As the amount of £100 for the given rate and time is to £100, so is the debt to the present value; which, subtracted from the whole debt leaves the discount.

What discount ought to be allowed on receiving present payment of a debt of £500, due 4 years hence, interest at 5 per cent. ?

           100
    4×5= 20   120 : 20 :: 500 : £83 6s. 8d. discount.
       ———   £500—£83 6s. 8d.=£416 13s. 4d. pres. val.
    amt.   120

What is the present value of £250, due 9 months hence, at 5 per cent.

```
   m.
6 | ½ | 100          100
3 | ½ |  50    int.    3 15
   |    25    amt. 103 15 : 100 :: 250 : £240 19s. 23⁄83 p. v.
   |    75
       5 p. c.    £250
      ————          240 19 23⁄83 present value.
      3,75         ———————
        20         9  0 60⁄83 discount.
      ————
      15,00
```

1. What ready money is equivalent to £150 16s. 4d. payable 3 months hence; allowing interest at 5 per cent.?
$\qquad$ *Ans.* £148 19s. 1d. $\frac{11}{61}$

2. What is the discount of a bill of £70, due 6 months hence, at $4\frac{1}{2}$ per cent.? *Ans.* £1 10s. $9\frac{1}{2}$d. $\frac{298}{400}$

3. Required the present worth of £300 15s., due 8 months hence, at 5 per cent. *Ans.* £291 0s. $11\frac{1}{2}$d. $\frac{14}{31}$

4. What is the discount on £56, due in 40 days, at 5 per cent.? *Ans.* 6s. 1d. $\frac{89}{367}$

5. What ready money will pay a debt of £350, due 146 days hence, at 5 per cent.? *Ans.* £343 2s. $8\frac{3}{4}$d. $\frac{39}{51}$

6. What is the present worth of £225, due 60 days hence, at 6 per cent.? *Ans.* £222 16s. $\frac{92}{1843}$

7. Required the discount on £150, due 80 days hence, at 5 per cent. *Ans.* £1 12s. 6d. $\frac{40}{41}$

8. What is the discount on £220, due 125 days hence, at 6 per cent.? *Ans.* £4 8s. 7d. $\frac{13}{149}$

9. What is the present worth of a bill of £1000, due 285 days hence, at 5 per cent.? *Ans.* £962 8s. 6d. $\frac{1224}{1317}$

II. Common or bankers' method of calculating discount.

RULE. Find the number of days the bill has to run, reckoning from the day it is discounted till the day it is payable, to which add 3 days of grace, then find the interest on the given sum. The answer thus found is called *discount*. Subtract the discount from the sum of the bill, the difference gives the proceeds.

10. Required the discount and net proceeds upon a bill of £573 16s. 8d. due 65 days hence, at 5 per cent.
$\qquad$ *Ans.* Disc. £5 2s. $2\frac{1}{4}$d. $\frac{7}{73}$; net pro. £568 14s. $5\frac{1}{2}$d. $\frac{66}{73}$

11. A bill of £400, dated August 4th, at 4 months, was discounted on the 10th of August: required the discount and net proceeds, at 5 per cent.
$\qquad$ *Ans.* Disc. £6 10s. $4\frac{3}{4}$d. $\frac{53}{73}$; net pro. £393 9s. 7d. $\frac{20}{73}$

12. What is the present worth of a bill of £1000, due 285 days hence, at 5 per cent.? *Ans.* £960 19s. 2d. $\frac{40}{73}$

13. A bill of £378, dated March 14, at 3 months, was discounted April 14: required the discount and proceeds, at 5 per cent. *Ans.* Disc. £3 6s. $3\frac{1}{4}$d. $\frac{151}{365}$; pro. £374 13s. $8\frac{1}{2}$d. $\frac{214}{365}$

14. What is the true, and bankers' discount, on a bill of £40, for 25 days, at 6 per cent.?
$\qquad$ *Ans.* True 3s. $3\frac{1}{4}$d. $\frac{115}{733}$, bankers' 3s. $3\frac{1}{4}$d. $\frac{59}{73}$

15. What is the true and bankers' discount on a bill of £800, for 360 days, at 6 per cent.?
$\qquad$ *Ans.* True £44 13s. 11d. $\frac{709}{1933}$, bankers' £47 6s. 10d. $\frac{14}{73}$

EQUATION OF PAYMENTS

Is the method of finding the time at which several debts, due at as many different times, may be paid at once.

RULE. Multiply each debt by the time it has to run before it is due, then divide the sum of these products by the sum of the debts, the quotient will be the time required.

I owe £60 in 40 days, £80 in 60, and £120 in 108 days: when may the whole be paid at once?

$$
\begin{array}{rll}
60 \times & 40 = & 2400 \\
80 \times & 60 = & 4800 \\
120 \times & 108 = & 12960 \\
\hline
260 & &)20160(77 \tfrac{7}{13} \text{ days.}
\end{array}
$$

1. R. is indebted to S. the sum of £628, which has to be paid thus; £100 at the end of 1½ years, £266 at the end of 2½ years, £134 at the end of 3 years, and the rest at the end of 4 years: at what time ought the whole to be discharged in one payment?   *Ans.* 2 years 274 $\frac{573}{628}$ days.

2. A. bought goods from B. to the value of £750, and agreed to pay £300 at 3 months, £400 at 6 months, and the rest at 8 months, but afterwards they agreed to make one payment of the whole: required the equated time for the payment.
Ans. 4 $\frac{14}{15}$ months.

3. A debt was to be discharged thus,—$\frac{1}{3}$ in ready money, $\frac{1}{5}$ at 3 months, $\frac{1}{5}$ at 4 months, $\frac{1}{5}$ at 6 months, and the rest at 8 months : find the time for paying the whole at once.
Ans. 4$\frac{1}{5}$ months.

4. Delivered to a banker the following bills, viz., A. B.'s bill for £100, due in 20 days ; T. R.'s bill for £264, due in 30 days ; and C. H.'s bill for £420, due in 60 days: at how many days should he grant me a bill for the whole?   *Ans.* 44 $\frac{30}{49}$ days.

5. A. is indebted to B. the sum of £750, which was to be paid thus: £250 at the end of 1½ years, £100 at the end of 2 years, and £400 at the end of 4 years: at what time ought the whole to be discharged in one payment?
Ans. 2 years 328¼ days.

BARTER.

BARTER is the method of exchanging goods without loss or gain to either party.

RULE. Find the value of the goods given away ; then find what quantity of the other may be purchased for that money.

1. How much tea, at 6s. 6d. per lb. should be given in barter for 142 yards of linen, at 3s. per yard?   *Ans.* 65 lb. $\frac{7}{13}$

2. How many yards of cloth, at 14s. per yd., should be given in barter for 20 cwt. sugar, at 7d. per lb.? *Ans.* 93$\frac{1}{3}$ yds.

3. Exchanged 156 yds. cloth, at 16s. 10d., for 936 yds. linen: what did the linen stand me per yard? *Ans.* 2s. 9$\frac{1}{2}$d. $\frac{2}{3}$

4. How much barley, at 8s. 3d. per bsh., should be received for 100 bsh. of wheat, at 10s. 1$\frac{1}{2}$d. per bsh.? *Ans.* 122 $\frac{8}{11}$ bsh.

·5. What was cloth per yard, when 66 yards of it were given for 70 gross of buttons, at 8$\frac{1}{2}$d. per doz. *Ans.* 9s. $\frac{1}{66}$

6. Exchanged 86 yards broadcloth, at 19s. 6d. per yard, for Irish linen at 3s. 4d. per yard: how much linen should I receive?
Ans. 503 $\frac{1}{10}$ yards.

7. Exchanged 159$\frac{1}{2}$ yards muslin, at 8s. 10d. per yard, for Hollands gin, at 26s. per gallon: how much gin should I receive?
Ans. 54 $\frac{59}{312}$ gallons.

8. Exchanged 67 cwt. tobacco, at £8 8s. per cwt., and received in part 600 lb. tea, at 7s. 4d., and for the rest I received stockings, at 2s. 8d. per pair: how many pair of stockings did I receive? *Ans.* 2571 pair.

9. Exchanged 154 yards cloth, at 14s. 10d., and for every 2 yards cloth that I gave, I got in return 7 yards muslin: how much muslin did I get, and what did it cost me per yard?
Ans. 539 yards, at 4s. 2d. $\frac{2}{4}$ $\frac{3}{7}$

10. E. and F. barter; E. has 60 yards superfine broadcloth, at 29s. 3d. per yard, for which F. would give him 102 yards common yd. wide, at 6s. 1$\frac{1}{2}$d. per yd. and the balance in money: how much money must E. receive? *Ans.* £56 10s. 3d.

11. Exchanged 38 dozen pair of shoes, at 7s. 8d. per pair, and got for them equal quantities of raisins, at 9$\frac{1}{2}$d. per lb., and figs at 5$\frac{1}{4}$d. per lb.: how many pounds of each did I receive?
Ans. 2844 $\frac{12}{59}$ lbs. of each.

12. A. barters silk stockings at 15s. with B. for hats at 18s.; but the stockings were worth only 13s. 4d. and the hats worth 16s.: which of them was the gainer? *Ans.* Neither.

13. Exchanged 97$\frac{1}{4}$ cwt. sugar, at 9$\frac{1}{4}$ per lb., for cloth, at 18s. 4$\frac{1}{2}$d. per yard: how much cloth should I receive?
Ans. 456 $\frac{53}{63}$ yards.

14. Exchanged 9 cwt. snuff, at £8 15s. and got for it, hemp at 9d. per lb. and flax at 1s. 4d., and got four times as much hemp as flax: how much did I get of each?
Ans. 363 $\frac{6}{13}$ lb. flax, 1453 $\frac{11}{13}$ lb. hemp.

15. Exchanged 27 cwt. cheese, at 93s. per cwt. and received for it wool, at 13s. per st., and butter at 22s. per st.; and got 3 st. butter as often as I got 7 st. wool: how much did I receive of each? *Ans.* 47 $\frac{154}{157}$ st. butter, 111 $\frac{150}{157}$ st. wool.

PROFIT AND LOSS.

The difference between the buying and selling price is called *Gain*, when the selling price is the greater, and *Loss*, when it is the less.

RULE. When the gain or loss on one article is given, the gain or loss on a given quantity is found by multiplying by that quantity; and when the gain or loss on a given quantity is given, the gain or loss on one article is found by dividing by that quantity. If the whole gain or loss, and that on one article, are given, the quantity is found by dividing by the gain or loss on one article.

1. Bought 428 yards cloth, at 14s. 8d. and sold it at 16s. 3d.: what did I gain?   *Ans.* £33 17s. 8d. gain.

2. Bought 57 cwt. of sugar, at £4 3s. 6d. per cwt., and sold it at $9\frac{3}{4}$d. per lb.: what was the gain?   *Ans.* £21 7s. 6d.

3. Bought 136 yards muslin, at 3s. 8d.: how must it be sold per yard, to gain £12 on the whole?   *Ans.* 5s. 5d. $\frac{3}{17}$ per yard.

4. Sold 257 yards linen, at 3s. 9d., and lost £9: what was it bought at per yard?   *Ans.* 4s. $5\frac{1}{4}$d. $\frac{159}{257}$.

5. Sold 13 doz. pair stockings, at 3s. 7d. per pair, and gained £11 10s.: what were they bought at?   *Ans.* 2s. $1\frac{1}{2}$d. $\frac{3}{13}$.

6. Bought cloth at 17s. 6d.: how much of it must I sell at 19s. to gain £43 13s. 6d.?   *Ans.* 582 yd. 1 qr. $1\frac{1}{4}$ na.

7. By selling tobacco at 3s. 6d. per lb., which had been bought at £14 10s. per cwt., I gained £130: how much did I sell?   *Ans.* 25 cwt. 1 qr. 26 lb. $\frac{46}{57}$.

8. By selling sugar at $8\frac{1}{4}$d. per lb., which had been bought at £4 4s. per cwt., I lost £85: what quantity did I sell?
          Ans. 242 cwt. 3 qr. 12 lb.

9. Bought 236 feet of wood, at 3s. 10d., and sold it at 3s. 5d. per foot: how much did I lose on it?   *Ans.* £4 18s. 4d.

10. Bought 234 cwt. iron, at 4s. 8d. per stone: at what should I sell it per lb. to lose £14 12s.?   *Ans.* $3\frac{3}{4}$d. $\frac{127}{273}$.

CASE II. Given the prime cost, and the profit or loss upon it; to find the profit or loss per cent.

RULE. As the prime cost is to the profit or loss on it, so is 100 to the profit or loss per cent.

11. Bought cloth at 3s. 8d. and sold it 4d. per yard profit: what was the gain per cent.?   *Ans.* 9 $\frac{1}{11}$.

12. Sold cloth *worth* 15s. per yard, at 1s. 6d. per yard loss: what was the loss per cent.?   *Ans.* 10 p. c..

13. Bought cloth at 9s. 6d. per yard, and sold it at 12s.: what was the gain per cent.?   *Ans.* £26 $\frac{6}{19}$

14. Bought tea at 5s. 6d. per lb., but, getting damaged, I was obliged to sell it at 4s. 9d.: what was my loss per cent.?
<div align="right">Ans. 13 $\frac{7}{11}$</div>

15. Bought 7 cwt. 3 qrs. of sugar, at 5$\frac{3}{4}$d. per lb., and sold it at 9d.: what did I gain per cent. and in all?
<div align="right">Ans. £11 15s. 1d. or 56 $\frac{12}{23}$ p. c.</div>

16. How much per cent. is 2$\frac{1}{4}$d. per shilling? Ans. 20 $\frac{5}{6}$

17. Bought a house for £315, paid for repairs £20, and sold it for £400: what was the gain per cent.? Ans. 19 $\frac{27}{67}$

CASE III. Given the rate per cent. and prime cost, to find the selling price.

RULE. As 100 is to 100, with the rate per cent. added to it in case of gain, or deducted from it in case of loss, so is the prime cost to the selling price.

18. Gained 9$\frac{1}{11}$ per cent. by cloth which I bought at 3s. 8d.: what did I sell it at?
<div align="right">Ans. 4s.</div>

19. Lost 10 per cent. by cloth which I bought at 15s.: what did I sell it at?
<div align="right">Ans. 13s. 6d.</div>

20. Bought cloth at 9s. 6d.: at what must I sell it to gain 26 $\frac{6}{19}$ per cent.?
<div align="right">Ans. 12s.</div>

21. I bought tea at 5s. 6d., but, getting damaged, am obliged to lose 13 $\frac{7}{11}$ per cent. by it: what must I sell it at to lose so much?
<div align="right">Ans. 4s. 9d.</div>

22. Bought sugar at 5$\frac{3}{4}$d. per lb.: what must I sell it at per lb. to gain 56 $\frac{12}{23}$ per cent.?
<div align="right">Ans. 9d.</div>

23. Bought coffee at 2s. per lb.: at what must I sell it per lb. to gain 20$\frac{5}{8}$ per cent.?
<div align="right">Ans. 2s. 5d.</div>

CASE IV. Given the rate per cent. and selling price, to find the prime cost.

RULE. As 100, with the rate per cent. added in case of gain or deducted in case of loss, is to 100, so is the selling price to the prime cost.

24. If I gain 9$\frac{1}{11}$ per cent. on cloth, which I sold at 4s., what was the prime cost?
<div align="right">Ans. 3s. 8d.</div>

25. Lost 10 per cent. on cloth, which I sold at 13s. 6d.: what was the prime cost?
<div align="right">Ans. 15s.</div>

26. Lost 13$\frac{7}{11}$ per cent. by selling tea at 4s. 9d.: what was the prime cost?
<div align="right">Ans. 5s. 6d.</div>

27. Gained 56 $\frac{12}{23}$ per cent. by selling goods at 9d.: what was the prime cost?
<div align="right">Ans. 5$\frac{3}{4}$d.</div>

28. Sold a quantity of cloth at 4s. 10d. per yard, by which I cleared 20$\frac{5}{8}$ per cent.: what did I buy it for?
<div align="right">Ans. 4s. per yard.</div>

29.   Sold cloth at 12s. on which I gained 26 $\frac{6}{10}$ per cent.: what was the prime cost?   *Ans.* 9s. 6d. per yard.

CASE V. Given two selling prices, and the rate per cent. in proportion to one of them ; to find the rate per cent. in proportion to the other.

RULE. As the price whose rate per cent. is given is to 100, with the given rate added or deducted, so is the other given price to a fourth number, from which subtract 100 in case of gain, but which subtract from 100 in case of loss. The remainder will be the required rate.

30.   By selling cloth at 5s. I gained 12 per cent.: what did I gain per cent. by selling it at 6s.?   *Ans.* 34$\frac{2}{5}$ p. c.

31.   By selling goods at 8s. I lost 14 per cent.: what will I lose by selling them at 7s. 6d.?   *Ans.* 19$\frac{3}{8}$ p. c.

32.   Sold goods at 15s. 6d., whereby I cleared 18 per cent., but, the commodity turning scarce, I sold what remained at 16s. 4d.: what did I clear per cent. by the latter price ?
                                        Ans. 24 $\frac{32}{93}$ p. c.

33.   By selling tea at 5s. 3d., I gained 16 per cent.; the same tea was afterwards sold at 4s. 6d.: what was lost or gained per cent. by the latter price ?   *Ans.* $\frac{4}{7}$ p. c. loss. ,

CASE VI. Given the whole gain or loss and the rate per cent. to find what the whole is bought and sold at.

RULE. As the rate is to 100, so is the gain to the buying price ; and the selling price is got by adding the gain or subtracting the loss.

34.   By selling goods at 5 per cent. profit, I gained £44 16s.: what did I pay for them ?   *Ans.* £896 prime cost.

35.   Sold 342 cwt. sugar, at 3 per cent. profit, and gained £53 14s.: what was it bought and sold at per cwt.?
Ans. £5 4s. 8d. $\frac{8}{57}$, bought p. cwt.; £5 7s. 9$\frac{3}{4}$d. $\frac{17}{57}$ sold p. cwt.

36.   Bought muslin at 5s. 8d., and by selling it again at 4$\frac{1}{2}$ per cent. profit, I gained £29 18s.: what quantity did I sell?
                                        Ans. 2345 $\frac{5}{31}$ yards.

37.   Sold tea at 7s. 8d., which was at 6 per cent. profit, and gained £33 6s. 8d.: what quantity did I sell?   *Ans.* 1536 $\frac{16}{69}$ lbs.

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MISCELLANEOUS EXERCISES.

1.   Bought cloth at 15s. per yard: how must it be sold per yard to gain £3 6s. 8d. on 80 yards, and what will be the gain per cent.?   *Ans.* 15s. 10d. or 5$\frac{5}{6}$ per cent.

2.   By selling cloth at 17s. 6d. per yard, I cleared 8 per cent.: how much did I clear per cent. by selling the same cloth at 18s. 3d.?   *Ans.* 12 $\frac{22}{35}$ per cent.

3. A. and B. barter; A. has 42 cwt. 2 qrs. of sugar, at £3 15s. per cwt., and 12 yards of cloth, at 9s. 1d. per yard; B. has 333¼ yards of Holland, at 8s. 3d. per yard: who must pay the balance and how much? *Ans.* B. must pay £27 6s. 6d. balance.

4. What is the interest of £10,007 for 5¾ years, at 6 per cent.? *Ans.* £3452 8s. 3½ ⅖

5. My agent sends me word that he has bought goods on my account to the value of £617 17s. 6d.: what will his commission come to at 2½ per cent.? *Ans.* £15 8s. 11¼d.

6. A certain debt is due as follows, viz., ⅙ at 3 months, ⅘ at 5 months, ⅜ at 7 months, and the rest at 12 months: now if it were agreed to pay the whole at once, what would be the mean time? *Ans.* 6⅔ months.

7. A legacy of £800 is left me by an uncle, to be paid 9 months after his decease; but I, being in want of ready money, agree with his executors to allow them 5 per cent. for prompt payment: how much will I receive? *Ans.* £771 1s. 8d. ²⁰⁄₂₃

8. Delivered 450 bolls barley to be malted, and during the process it increased in quantity at the rate of 3 bolls in 7: what quantity of malt had I? *Ans.* 642⁶⁄₇ bolls malt.

9. A farmer kiln-dried 285 bl. corn, by which it inlaked 3 bl. on 40: how much did the dry corn measure? *Ans.* 263⅝ bl. dry.

10. A merchant's capital was £1260, and he has since increased it at the rate of £13 on £20: what is it now?
Ans. £2079 present capital.

11. A gentleman has 129 oz. 15 dwts. of old silver, which he values at 4s. 3d. per oz., and he proposes to add £83 2s. 9¾d. thereto, in order to purchase a very curious and valuable piece of plate, weighing 260 oz. 10 dwt.: required how much the plate was rated at per oz.? *Ans.* 8s. 6d.

12. Bought hops at £5 5s. per cwt.: how must they be sold per lb. to gain 15 per cent.? *Ans.* 1s. 0¾d. ¾

13. Shipped for Holland 2600 pieces of linen, each 9¼ yards, at 3s. 10½d. per yard; to get in return one half in gin, at £65 per tun, the other half in tea, at £3 10s. per canister: what quantity of each should I receive?
Ans. 364 tuns 1 hhd. gin, and 6764 ⁹⁄₁₄ can. tea.

14. An agent is allowed 5½ per cent. for commission and risk of bad debts: what is his income, supposing his sales to amount to £20178 17s. 6½d., his losses to £300 17s., and his doubtful debts, which are valued at 12s. 6d. per pound, to £600 17s. 6d.? *Ans.* £583 13s. 2¼d. ⁷¹⁄₁₀₀ income.

15. What is the net weight of 7 chests tea, each 16 cwt. 3 qrs. 16 lb., tare 20 lb. per cwt., allowing also the usual tret and cloff? *Ans.* 92 cwt. 3 qrs. 11 lb.

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16. An agent charges $4\frac{1}{4}$ per cent. for commission and risk of bad debts; his sales in a year amount to £14730, and his losses to £230: what is his net income?   *Ans.* £398 3s.

17. What is the interest of £256, from May 7 till August 12, at $5\frac{1}{2}$ per cent.?   *Ans.* £3 14s. 10d. $\frac{62}{1825}$

18. £240 is to be paid as follows, viz., £60 in 60 days, £80 in 96 days, £40 in 250 days, and the rest in a year and 35 days: required the equated time for paying the whole?
                              Ans. $188\frac{2}{3}$ days.

19. Received 125 yards of cloth, at 5s. 6d. for 215 lb. of tea: required the price of the tea.   *Ans.* 3s. $2\frac{1}{4}$d. $\frac{21}{43}$ per lb.

20. What is the interest of £150, from January 7 till August 23, at 6 per cent.?   *Ans.* £5 12s. $5\frac{1}{4}$d. $\frac{3}{73}$

21. If 12 men build a wall 30 feet long, 6 feet high, and 3 feet thick, in 15 days; in how many days will 60 men build a wall 300 ft long, 8 ft. high, and 6 ft. thick?   *Ans.* 80 days.

22. There is £1000 to be divided among 3 men, in such proportion, that if A. has £3, B. shall have £5, and C. £8: how much must each man have?
             Ans. A. £187 10s., B. £312 10s., C. £500.

23. A gentleman having 50s. to pay among his labourers for a day's work, gave to every boy 6d., to every woman 8d., and to every man 16d.; the number of boys, women, and men, was the same: required the number of each.
                              Ans. 20 of each.

24. After the conquest of Canada from the French, a gentleman made a purchase of 976 acres, French measure: how many English acres may he reckon upon, supposing 16 of the former equivalent to 19 of the latter?   *Ans.* 1159 English acres.

25. What discount ought to be allowed on receiving present payment of a debt of £375 10s. due 3 years hence ; reckoning interest at 6 per cent.   *Ans.* £57 5s. 7d. $\frac{7}{59}$

26. If an agent transact business to the amount of £64896 per annum, and is allowed $2\frac{1}{4}$ per cent., what is his income, supposing he loses by bad debts £548?   *Ans.* £912 3s. $2\frac{1}{4}$d. $\frac{3}{5}$

27. Three gardeners, A. B. and C. having bought a piece of ground, find the profits of it amount to £120 per annum. Now the money which they laid down was in such proportion that as often as A. paid £5 B. paid £7, and as often as B. paid £4 C. paid £6 : required how much each man must have per annum of the gain.
             Ans. A. £26 13s. 4d. ; B. £37 6s. 8d. ; C. £56.

28. A. barters with B. tea worth 5s. 6d. at 6s. 3d., for rum worth 7s. at 7s. 11d.: who has the advantage, and how much?
                  Ans. A.'s advantage $\frac{5}{11}$d. per gallon.

29. A woollen manufacturer sold 3 pieces broadcloth, each 27 yards, at 17s. 3d., and 5 pieces narrow cloth, each 31 yards at 11s. 7d.; he allowed 5 per cent. discount for prompt payment: what did he receive? *Ans.* £151 13s. 0¼d. ⅔

30. A. values cloth in barter at 6s. 3d., worth only 5s. 9d.: how must B. value cloth worth 7s. 2d. to be even with him ?
Ans. 7s. 9d. $\frac{11}{23}$ per yard.

31. If 8 horses require £40 worth of hay in 6 months, when hay sells at 8d. per stone: how much will it require to maintain 7 horses for 11 months, when hay sells at 5d. per stone ?
Ans. £40 2s. 1d.

32. Exchanged 124 yards shirting, at 2s. 6d. per yard, for 100 yards printed cotton, at 1s. 4d. per yard, and the remainder in ribbons, at 1s. 2d. per yard: how many yards of ribbon should I receive ? *Ans.* 151$\frac{3}{7}$ yards.

33. A. B. and C. rent a grass enclosure, for which they agree to pay $80 ; A. puts in 8 cattle for 180 days, B. 6 cattle for 150 days, and C. 20 cattle for 123 days: how much of the rent should each pay ? *Ans.* A. $24, B. $15, C. $41.

34. After seeing a flash of lightning, 24 seconds elapsed before the thunder was heard: required the distance, sound moving at the rate of 1142 feet per second.
Ans. 5 miles 336 yards.

35. A steeple projected a shadow of 200 feet, when a staff 4 feet high projected 6 feet of shadow: required the height of the steeple. *Ans.* 133⅓ feet.

36. A. has 96 gallons gin, worth 16s. 6d., which he wishes to exchange with B. for wine worth £2 2s. per dozen, but B. demands 45s. for his wine in barter: how much should A. demand for his gin, not to be a loser, and how much wine should he get for it ? *Ans.* 37$\frac{5}{7}$ dozen at 17s. 8¼d.

37. The capital of a mercantile house is divided into 20 shares, of which A. has 4, B. 5, C. 9, and D. 2 shares ; £975 of profits are to be divided among the partners: how much of that sum should each receive?
Ans. A. £195, B. £243 15s., C. £438 15s., D. £97 10s.

38. When the barometer stands at 30 inches, there are about 14¾ lbs. of pressure by the atmosphere on every square inch of the human body ; now, if the surface of a man's body contain 15 square feet, how many tons weight of air has he to sustain for his usual load ? *Ans.* 14 tons 500 lb.

39. When I was a boy, I recollect hearing distinctly, though 42 miles distant, the report of the cannons fired in Edinburgh Castle: how long was that after the discharge of the gun?
Ans. 3 min. 14 $\frac{106}{571}$ sec.

40. Bought a quantity of cloth for £412 10s.; 85 yds. getting damaged, were sold at 15s. per yd. whereby I lost £6 7s. 6d.; but sold the remainder so as to gain £17 16s. 8d. upon the whole: required the quantity bought, and at what the undamaged part was sold per yard.   *Ans.* 500 yards, sold at 17s. 8d.

41. Bought goods at 6s. 3d. per quarter, and sold them at £1 18s. 6d. per cwt.: what was gained on 27 cwt., and how much per cent.?   *Ans.* £18 4s. 6d. or 54 per cent.

42. The sum of £20 0s. 6d. is to be divided among four classes of poor people; there are 7 in the first class, 9 in the second, 15 in the third, and 20 in the fourth; the share of the first is double that of the second, the second triple that of the third, and the third quadruple that of the fourth: required the share of each class.

> *Ans.* 1s. 1½d. share 4th class, 4s. 6d. share 3d. class,
> 13s. 6d. share 2d class, 27s. share 1st class.

43. Sold a quantity of cloth at 3s. 3d. per yard, by which I gained £12, at the rate of 8¼ per cent.: required the quantity sold, and the prime cost?   *Ans.* 960 yards, bought at 3s.

44. Shipped on an adventure to Lisbon, 300 barrels of salmon, at £3 18s. 6d., 450 yards linen, at 2s. 7d., 1200 yards broadcloth, at 16s., insurance and charges of shipping £44 8s. 6d.; the net proceeds, as per account of sales, was £2440 16s. 4d.: required the gain or loss, and how much per cent.

> *Ans.* £200 15s. 4d. gain, £8 $\frac{129376}{133403}$ gain per cent.

45. A merchant imported 11 pipes of wine, which cost him £31 10s. per pipe, and which were bottled into 52 doz. each; bottles and other charges 2s. 4d. per dozen ; he sold one half of it at 16s. 2d. per dozen, and the other half at 17s. per dozen: what did he gain or lose upon the whole? *Ans.* £61 1s. gain.

QUESTIONS FOR EXAMINATION IN PART III.

What is Simple Proportion? *Ans.* It is the method of finding a fourth proportional number to three other given numbers, so that the third shall have the same *ratio* to the fourth that the first has to the second. What do you mean by *ratio*? *Ans.* It is the relation which one number bears to another with respect to magnitude, and can only exist between quantities of the same kind,

> thus:—12 yards : 6 yards : : £8 : £4.
> or,   4 shil. : 16 shil. : : 3 yd. : 12 yd.

In a Simple Proportion question, how many terms must be given? *Ans.* Always three to find the fourth, or answer. How

do you state a question in Proportion? After it is stated how do you proceed in working it? What is Compound Proportion? What is Distributive Proportion? What sort of a rule is that called Practice? How are questions in Practice solved? What are the aliquot parts of a pound? of a shilling? &c. What are the aliquot parts of a cwt.? of a qr.? an oz. troy? When the price of one is an even part of a penny, shilling, or pound, how do you find the price of a large number? When the price consists of pence and farthings, not an even part of a shilling, how do you proceed? When the price consists of shillings, pence and farthings, what do you then do? &c. What is the rule on Allowances on Goods commonly called? What is the meaning of gross weight? What is tare? tret? cloff? net weight? What is Simple Interest? What does per cent. (*centum*) mean? *Ans.* per 100. What is the meaning of per annum? *Ans.* Yearly. What is the principal? interest? amount? legal interest? usury? How do you find the interest of any sum of money for any number of years? for months? for weeks? for days? What is the meaning of Compound Interest? What is Commission or Brokerage? What is Insurance? What is the meaning of insurer? insured? premium? policy? What do you mean by the funds or stocks? How do you find the value of any quantity of stock? How do you find how much stock may be bought for a given sum? How do you find the rate of interest arising from money invested in the stocks? What is the meaning of Discount? What is the true method of finding the present value of a sum of money due at a future period? What is the common way, or the way bankers discount bills? Is this a true and correct method? *Ans.* No; it makes the discount a little more than it ought to be. What is the meaning of Equation of Payments? How do you find the equated or equal time? What is the meaning of Barter? How do you solve questions in this rule? Is there not a rule of first rate commercial importance called Profit and Loss? *Ans.* Yes; by it the merchant is enabled to calculate the gain or loss per cent., prime cost, selling price, &c., upon every transaction in business; hence this rule is peculiarly the spirit or essence of mercantile speculations, so far as the science of numbers is concerned. How do you find the profit or loss per cent. when the prime cost and the profit or loss on it are given? How do you find the selling price, when the rate per cent. and prime cost are given? How do you find the prime cost, when the rate per cent. and selling price are given? Given two selling prices and the rate per cent. in proportion to one of them; how do you find the rate per cent. corresponding to the other?

Given the whole gain or loss and the rate per cent.; how do you find what the whole was bought and sold at?

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PART IV.

VULGAR FRACTIONS.

1. A *Fraction* is one or more parts of an integer, and is expressed by a number above, and another below a line drawn between them: thus, $\frac{4}{7}$.

The number below the line is called the *denominator*, because it denominates or shows into how many parts the integer is divided; and the number above is called the *numerator*, because it enumerates or shows how many of these parts the fraction contains. The numerator and denominator are called the terms of the fraction.

2. There are *two* kinds of vulgar fractions, simple and compound.

3. A *simple fraction* consists of a numerator and denominator, as $\frac{7}{8}$, and is divided into two kinds, proper and improper.

4. A *proper fraction* is when the numerator is less than the denominator, as $\frac{2}{3}$.

5. An *improper fraction* is when the numerator is equal to or greater than the denominator, as $\frac{4}{4}$ $\frac{7}{4}$.

6. A *compound fraction* consists of two or more fractions joined together by the word of, as $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$.

7. A *mixed number* or fraction consists of a whole number and a simple fraction, as $9\frac{2}{7}$.

8. A *complex fraction* is that which has a fraction or a mixed number in either or both of its terms, as

$$\frac{\frac{1}{4}}{7} \quad \text{or} \quad \frac{3}{10\frac{1}{4}} \quad \text{or} \quad \frac{5\frac{1}{2}}{9} \quad \text{or} \quad \frac{2\frac{1}{3}}{5\frac{1}{4}}$$

When the numerator is equal to the denominator, the fraction is equal to the integer; thus, $\frac{6}{6}=1$.

And when the numerator is greater than the denominator, the fraction is greater than the integer, as $\frac{5}{3}=1\frac{2}{3}$.

Note. If the numerator and denominator of a fraction be either multiplied or divided by the same number, the product or quotient will be a new fraction, equal to the former; thus, $\frac{4}{12}\div\frac{2}{2}=\frac{2}{6}$, or $\frac{4}{12}\times\frac{3}{3}=\frac{12}{36}$, all of which have the same value, $\frac{4}{12}=\frac{2}{6}=\frac{12}{36}$.

REDUCTION OF VULGAR FRACTIONS.

CASE I. To reduce fractions to their least terms.

RULE. Divide the greater term by the less, and that divisor by the remainder, the next divisor by the next remainder, and so on, always dividing the next divisor by the next remainder, till nothing remains; the last divisor is the greatest *common measure;* by which divide the terms of the fraction for the answer.

Reduce $\frac{378}{1233}$ to its least terms.

$$378)1233(3$$
$$1134$$
$$99)378(3$$
$$297$$
$$81)99(1$$
$$81$$
$$18)81(4$$
$$72$$
$$9)18(2$$
$$18$$
$$\cdots$$

$9)\frac{378}{1233}=\frac{42}{137}$ ans.

Reduce to their least terms.

1. $\frac{267}{336}$. ans. $\frac{89}{112}$.   4. $\frac{832}{618}$. ans. $\frac{416}{309}$.   7. $\frac{901}{1008}$. ans. $\frac{89}{112}$.
2. $\frac{315}{840}$. ans. $\frac{3}{8}$.   5. $\frac{339}{486}$. ans. $\frac{113}{162}$.   8. $\frac{75}{1200}$. ans. $\frac{8}{8}$.
3. $\frac{618}{497}$. ans. $\frac{618}{497}$.   6. $\frac{756}{2466}$. ans. $\frac{42}{137}$.   9. $\frac{736}{872}$. ans. $\frac{92}{109}$.

Note. To reduce fractions to less terms.

RULE. When the terms of the fraction end with 5 or 0, divide by 5 ; when with an even number or cipher, divide by 2 ; when there are ciphers at the end of each, cut off as many as are common to both ; and when any number will divide both numerator and denominator, without a remainder, divide them by it.

Reduce to less terms.

1. $\frac{740}{635}$.   4. $\frac{840}{700}$.   7. $\frac{672}{80}$.   10. $\frac{44}{83}$.
2. $\frac{6000}{4800}$.   5. $\frac{75}{90}$.   8. $\frac{40}{88}$.   11. $\frac{125}{25}$.
3. $\frac{979}{938}$.   6. $\frac{408}{800}$.   9. $\frac{180}{273}$.   12. $\frac{1700}{8800}$.

Case II. To reduce an improper fraction to a whole ·or mixed number.

Rule. Divide the numerator by the denominator, the quotient will be the whole number; the remainder, if any, a numerator, and the divisor its denominator ; annex this fraction to the whole number.

Reduce to whole or mixed numbers.

1. $\frac{74}{4}$. ans. $8\frac{17}{19}$. | 4. $\frac{1748}{17}$. ans. $102\frac{14}{17}$. | 7. $\frac{72}{6}$. ans. 12.
2. $\frac{24}{3}$. ans. 8. | 5. $\frac{65}{5}$. ans. 13. | 8. $\frac{1486}{117}$. ans. $12\frac{82}{117}$.
3. $\frac{187}{27}$. ans. $6\frac{25}{27}$. | 6. $\frac{178}{9}$. ans. $19\frac{7}{9}$. | 9. $\frac{2075}{641}$. ans. $3\frac{152}{641}$.

Case III. To reduce a mixed number to an improper fraction.

Rule. Multiply the whole number by the denominator of the fraction ; to the product add the numerator, under which place the denominator.

A whole number is reduced to the form of a fraction, by putting 1 for its denominator.

Reduce to improper fractions.

1. 67. ans. $\frac{67}{1}$. | 4. $6\frac{1}{4}$. ans. $\frac{25}{4}$. | 7. $174\frac{3}{8}$. ans. $\frac{3135}{18}$.
2. 46. ans. $\frac{..}{..}$. | 5. 7. ans. $\frac{7}{1}$. | 8. $16\frac{4}{10}$. ans. $\frac{309}{10}$.
3. 19. ans. $\frac{19}{1}$. | 6. $17\frac{3}{4}$. ans. $\frac{71}{4}$. | 9. $319\frac{1}{26}$. ans. $\frac{3110}{26}$.

Note. To reduce a whole number to a fraction of a given denominator.

Rule. Multiply the whole number by the given denominator for the numerator, under which place the denominator.

10. Reduce 3 to a fraction, having 5 for its denominator.
                                                    Ans. $\frac{15}{5}$.

11. Reduce 11 to a fraction, having 9 for its denominator.
                                                    Ans. $\frac{99}{9}$.

12. Reduce·27 to a fraction, having 14 for its denominator.
                                                    Ans. $\frac{373}{14}$.

Case IV. To reduce a compound fraction to a simple one.

Rule. Multiply all the numerators together for the numerator, and all the denominators for the denominator of the simple fraction.

Note. Shorten the operation in this rule by cancelling the numerators and denominators. Do the same when you come to multiplication, division, and proportion of vulgar fractions.

Reduce $\frac{3}{8}$ of $\frac{12}{15}$ of $\frac{4}{5}$ of $\frac{5}{8}$ to a simple fraction.

$$\overset{\displaystyle\overset{e}{2}}{\underset{\underset{\underset{e}{2}}{c}}{\overset{d}{\frac{3}{8}}} \times \underset{\underset{5}{d}}{\overset{a}{\frac{12}{15}}} \times \underset{b}{\overset{c}{\frac{4}{5}}} \times \underset{a}{\overset{b}{\frac{5}{8}}} = \frac{1}{5} \text{ ans.}}$$

Reduce to a simple fraction.

1. $\frac{1}{5}$ of $\frac{3}{4}$ of $\frac{5}{6}$.　ans. $\frac{5}{6}$c　6. $\frac{1}{8}$ of $\frac{5}{6}$ of $7\frac{1}{4}$.　ans. $\frac{145}{72}$.
2. $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{7}{8}$.　ans. $\frac{7}{16}$.　7. $\frac{4}{9}$ of 6^3 of 8.　" $1\frac{1}{5}6$.
3. $\frac{4}{9}$ of $\frac{5}{6}$ of $\frac{6}{10}$.　ans. $\frac{1}{4}$　8. $\frac{2}{3}$ of $\frac{9}{10}$ of $7\frac{1}{2}$ of 10. " $1\frac{28}{5}$.
4. $\frac{5}{6}$ of $\frac{1}{9}$ of 9.　ans. $\frac{15}{8}$　9. $6\frac{4}{5}$ of $9\frac{3}{12}$ of 12.　" $14\frac{43}{2}$.
5. $\frac{7}{10}$ of $\frac{5}{9}$ of $\frac{1}{7}$ of 8. ans. $\frac{8}{15}$　10. $\frac{2}{3}$ of $\frac{6}{5}$ of $\frac{10}{8}$ of $\frac{7}{8}$. " $\frac{7}{6}$.

CASE V. To reduce fractions of different denominators to others of equal value that have a common one.

RULE. Reduce them to simple fractions, then multiply each numerator into all the denominators except its own, for the new numerators, and multiply all the denominators together for a common denominator.

Reduce $\frac{3}{4}$, $\frac{1}{2}$, $\frac{2}{3}$ and $\frac{5}{8}$ to a common denominator.

$3 \times 2 \times 3 \times 8 = 144$ N.　hence the 4 new fractions are
$1 \times 4 \times 3 \times 8 = 96$ N.　$\frac{144}{192}, \frac{96}{192}, \frac{128}{192}, \frac{120}{192}$.
$2 \times 4 \times 2 \times 8 = 128$ N.　and they have the same value of
$5 \times 4 \times 2 \times 3 = 120$ N.　the former ones, viz.,
$4 \times 2 \times 3 \times 8 = 192$ C.D.　$\frac{3}{4} = \frac{144}{192}, \frac{1}{2} = \frac{96}{192}, \frac{2}{3} = \frac{128}{192}, \frac{5}{8} = \frac{120}{192}$.

Reduce to a common denominator.

1. $\frac{7}{9}$ and $\frac{3}{4}$.　　　Ans. $\frac{28}{36}$ and $\frac{27}{36}$.
2. $\frac{1}{2}, \frac{2}{7}$, and $\frac{5}{8}$.　　" $\frac{5}{112}, \frac{32}{112}$, and $\frac{70}{112}$.
3. $\frac{6}{7}, \frac{3}{5}$ and $\frac{9}{10}$.　　" $\frac{210}{280}, \frac{210}{280}$, and $\frac{252}{280}$.
4. $\frac{1}{7}, \frac{2}{9}, \frac{3}{11}$ and $\frac{3}{10}$.　　" $\frac{990}{6930}, \frac{1540}{6930}, \frac{1890}{6930}$, and $\frac{2079}{6930}$.
5. $\frac{4}{7}, \frac{3}{10}, \frac{5}{8}$ and $\frac{2}{3}$.　　" $\frac{960}{1680}, \frac{504}{1680}, \frac{1050}{1680}$, and $\frac{1120}{1680}$.
6. $\frac{1}{2}$ of $\frac{1}{2}, \frac{3}{4}$ of $\frac{1}{2}$, and $\frac{2}{3}$ of $\frac{3}{5}$. " $\frac{120}{480}, \frac{180}{480}$, and $\frac{123}{480}$.
7. $3\frac{1}{2}, \frac{1}{3}$ of 4, and $\frac{2}{3}$ of $\frac{6}{8}$.　" $\frac{84}{24}, \frac{32}{24}$, and $\frac{8}{24}$.
8. $\frac{4}{5}$ of $5, 6\frac{4}{5}$, and $\frac{1}{2}$ of $4\frac{1}{2}$.　" $\frac{80}{20}, \frac{136}{20}$, and $\frac{45}{20}$.

Note. When of two fractions the one denominator can divide the other, without a remainder, multiply the terms of that which has the less denominator by the quotient.

Reduce to a common denominator.

9. $\frac{7}{10}$ and $\frac{3}{5}$. ans. $\frac{7}{10}$ and $\frac{6}{10}$.　11. $\frac{4}{21}$ and $\frac{3}{7}$. ans. $\frac{4}{21}$ and $\frac{9}{21}$.
10. $\frac{7}{12}$ and $\frac{5}{4}$. ans. $\frac{7}{12}$ and $\frac{15}{12}$.　12. $\frac{6}{25}$ and $\frac{11}{5}$. ans. $\frac{6}{25}$ and $\frac{55}{25}$.

Sometimes a number of fractions may be brought to a common denominator very easily, when any number of the less denominators are equal to the greatest. For example:

$\frac{1}{2}$, $\frac{1}{4}$, $\frac{2}{5}$, $\frac{3}{10}$, $\frac{13}{20}$, reduced to a common denominator,
$\frac{10}{20}$, $\frac{5}{20}$, $\frac{8}{20}$, $\frac{6}{20}$, $\frac{13}{20}$, are equal to.

Or, $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{5}$, $\frac{5}{8}$, $\frac{7}{10}$, $\frac{9}{20}$, $\frac{17}{40}$, red. to a c. d. are
$\frac{20}{40}$, $\frac{10}{40}$, $\frac{24}{40}$, $\frac{25}{40}$, $\frac{28}{40}$, $\frac{18}{40}$, $\frac{17}{40}$, equal to.

CASE VI. To reduce a complex fraction to a simple one.

RULE. Reduce both the numerator and denominator to a simple fraction, then multiply the numerator of each of these fractions by the denominator of the other, for the simple fraction.

Reduce $\dfrac{3}{10\frac{1}{4}}$ to a simple frac.	Reduce $\dfrac{5\frac{1}{2}}{9}$ to a simple frac.

$\frac{3}{1}$— 3×4=12

——————   —ans.

$\frac{41}{4}$—41×1=41

$\frac{11}{2}$—11×1=11

——————   —ans.

$\frac{9}{1}$— 9×2=18

Reduce $2\frac{1}{3}$ to a
$\overline{4\frac{3}{4}}$
simple fraction.

$\frac{7}{3}$ — 7×4=28

——————   —ans.

$\frac{19}{4}$—19×3=57

1. Reduce $\dfrac{4}{11\frac{3}{11}}$ to a simple fraction.   Ans. $\frac{11}{31}$.

2. Reduce $\dfrac{13\frac{2}{5}}{19}$ to a simple fraction.   Ans. $\frac{111}{152}$.

3. Reduce $\dfrac{\frac{9}{11}}{83\frac{1}{3}}$ to a simple fraction.   Ans. $\frac{27}{2750}$.

CASE VII. To reduce fractions from one denomination to another.

RULE. If from a less name to a greater, multiply the denominator by the number of the less that makes one of the greater; if from a greater to a less, multiply the numerator by that number.

Reduce $\frac{4}{9}$ of a farthing to the fraction of a pound.

$$\frac{4}{9\times 4\times 12\times 20} = \frac{4}{8640} = \frac{1}{2160} \text{ £.}$$

Reduce £$\frac{1}{2160}$ to the fraction of a farthing.

$$\frac{1\times 20\times 12\times 4}{2160} = \frac{960}{2160} = \frac{4}{9}\text{far.}$$

The following questions prove each other in the same manner.

1.	Reduce $\frac{4}{5}$ of a shilling to the fraction of a guinea.		1.	Reduce $\frac{4}{105}$ of a guinea to the fraction of a shilling.
2.	$\frac{9}{11}$ sh.	moidore.	2.	$\frac{1}{33}$ moid. — shilling.
3.	$\frac{5}{12}$ crown	pound.	3.	$\frac{5}{48}$ pound — crown.
4.	$\frac{4}{7}$ far.	shilling.	4.	$\frac{1}{84}$ shil. — farth.
5.	$\frac{2}{3}$ hf. cr.	pound.	5.	$\frac{1}{12}$ pound — h. cr.
6.	$\frac{7}{8}$ penny	guinea.	6.	$\frac{1}{288}$ gui. — pen.
7.	$\frac{5}{9}$ lb.	ton.	7.	$\frac{1}{3136}$ ton — lb.
8.	$\frac{8}{9}$ oz.	cwt.	8.	$\frac{1}{2016}$ cwt. — ounce.
9.	$\frac{4}{5}$ dram.	lb.	9.	$\frac{1}{320}$ lb. — dram.
10.	$\frac{9}{11}$ yard	mile.	10.	$\frac{9}{10360}$ m. — yard.
11.	$\frac{12}{13}$ sec.	hour.	11.	$\frac{1}{3600}$ hour — sec.
12.	$\frac{5}{8}$ per.	acre.	12.	$\frac{1}{236}$ acre — perch.

13.	Reduce £$\frac{1}{5}$ to the fraction of a guinea.		13.	Reduce $\frac{16}{21}$ guinea to the fraction of a pound.
14.	$\frac{7}{8}$ crown	moidore.	14.	$\frac{35}{216}$ moid. — crown.
15.	$\frac{3}{4}$ pound	joan.	15.	$\frac{5}{12}$ joan. — pound.
16.	$\frac{4}{5}$ yard	ell Eng.	16.	$\frac{12}{25}$ ell Eng. — yard.
17.	$\frac{2}{3}$ ell Fl.	ell Eng.	17.	$\frac{2}{3}$ ell Eng. — ell Fl.
18.	$\frac{4}{9}$ crown	guinea.	18.	$\frac{20}{189}$ guin. — crown.

Note. In the following questions, reduce the given quantity to the lowest name in it for the numerator; and reduce the denomination it is required to be reduced to, into the same name for the denominator.

Reduce 8s. 6½d. to the fraction of a pound	8s. 6½d.=410 far.—41
	———— —ans.
	£1 =960 far.—96

The following questions and those in the next case prove each other.

1.	Reduce 7d. to the fraction of a pound		13.	Reduce 7 fur. 4 pol. to the fraction of a mile.	
2.	4½d.	shilling.	14.	8¾d.	crown.
3.	9¾	guinea.	15.	6s. 10½d.	hf. gui.
4.	19s. 8d.	£.	16.	13 lb. 4 oz.	ton.
5.	7s. 8½d.	£.	17.	7 dwt. 13 gr.	oz.
6.	4 lb. 3 dr.	cwt.	18.	8 gal. 7 pts.	qr.
7.	7¾ drams	lb. av.	19.	17 gal. 5 pts.	qr.
8.	8 dwt. 17½ gr.	lb. tr.	20.	3 bus. 3 pk.	qr.
9.	7 gal. 3⅕ pts.	qr.	21.	5 oz. 7 gr.	lb. tr
10.	5 d. 3 h. 17 m.	yr.	22.	2 ro. 17 pol.	acre.
11.	5 yds. 2⅕ ft.	mile.	23.	24 seconds	hour.
12.	3 ro. 5 po.	acre.	24.	15 h. 15 m.	day.

Case VIII.   To find the value of a fraction.

Rule.   Reduce the numerator into the next inferior name, and divide by the denominator. Reduce the remainder into the next lower name, and divide again, and so on, as far as necessary.

What is the value of £$\frac{41}{96}$?	What is the value of $\frac{47}{64}$ qr.
96)41	64)47
20	8
—— s. d.	—— bus. pk. gal.
820 (8 6½ ans.	376(5 3 1 ans.
768	320
——	——
52	56
12	4
——	——
624	224
576	192
——	——
48	32
4	2
——	——
192	64
192	64

What is the value of

1. $\frac{7}{240}$ pound ?
2. $\frac{3}{8}$ shilling ?
3. $\frac{13}{336}$ guinea ?
4. $\frac{59}{80}$ pound ?
5. $\frac{37}{96}$ pound ?
6. $\frac{7027}{28672}$ cwt. ?
7. $\frac{31}{1623}$ lb. av. ?
8. $\frac{523}{14400}$ lb. tr. ?
9. $\frac{37}{320}$ qr. corn ?
10. $\frac{7397}{525600}$ year ?
11. $\frac{43}{13200}$ mile ?
12. $\frac{25}{36}$ acre ?
13. $\frac{71}{80}$ mile ?
14. $\frac{7}{16}$ crown ?
15. $\frac{55}{84}$ hf. guin.?
16. $\frac{53}{980}$ ton ?
17. $\frac{181}{480}$ oz. tr. ?
18. $\frac{71}{512}$ quarter?
19. $\frac{141}{512}$ quarter ?
20. $\frac{15}{32}$ quarter ?
21. $\frac{2407}{5760}$ lb. tr.?
22. $\frac{07}{160}$ acre ?
23. $\frac{1}{150}$ hour ?
24. $\frac{61}{96}$ day ?

Note. Of two given fractions, to find which has the greater value.

Rule. Multiply each numerator into the other's denominator, and if the products be equal, so are the fractions; otherwise the numerator of that fraction, which has the greater value, multiplied by the other's denominator, will give the greater product.

Whether has the greater value.

1. $\frac{7}{8}$ or $\frac{101}{87}$. ans. $\frac{7}{8}$.
2. $\frac{14}{17}$ or $\frac{20}{10}$. ans. $\frac{14}{17}$.
3. $\frac{6}{18}$ or $\frac{4}{15}$. equal.
4. $\frac{12}{27}$ or $\frac{15}{38}$. ans. $\frac{12}{27}$.
5. $\frac{11}{19}$ or $\frac{43}{80}$. ans. $\frac{43}{80}$.
6. $\frac{120}{144}$ or $\frac{5}{6}$. equal.

ADDITION OF VULGAR FRACTIONS.

RULE. Reduce the given fractions to simple ones, and to a common denominator; then add the numerators, and under their sum write the common denominator.

add $\frac{3}{4}$, $\frac{5}{8}$, $\frac{4}{5}$, and $\frac{1}{2}$ together.

$3\times8\times5\times2=240$
$5\times4\times5\times2=200$
$4\times4\times8\times2=256$
$1\times4\times8\times5=160$

$\overline{\qquad856\qquad}$
$\frac{856}{\qquad}=2\frac{216}{320}$ a.
$4\times8\times5\times2=320$

$\frac{5}{6}+\frac{1}{2}$ of $\frac{3}{4}+10$.
$\frac{5}{6}+\frac{3}{8}+\frac{10}{1}$.

$5\times8\times1= 40$
$3\times6\times1= 18$
$10\times6\times8=480$

$\overline{\qquad538\qquad}$
$\frac{538}{\qquad}=11\frac{5}{24}$ a.
$6\times8\times1= 48$

1. What is the sum of $\frac{1}{8}+\frac{5}{8}+\frac{3}{8}+\frac{7}{8}$?   *Ans.* 2.
2. What is the sum of $\frac{3}{4}+\frac{5}{6}+\frac{7}{8}$?   " $2\frac{11}{24}$.
3. What is the sum of $\frac{4}{7}+\frac{1}{4}+\frac{1}{6}+\frac{4}{9}$?   " $1\frac{245}{252}$.
4. What is the sum of $\frac{1}{2}+\frac{2}{3}+5$?   " $6\frac{1}{6}$.
5. What is the sum of $\frac{5}{8}+\frac{6}{7}+\frac{1}{3}+\frac{5}{9}$?   " $2\frac{187}{504}$.
6. What is the sum of $\frac{2}{15}+\frac{6}{15}+\frac{4}{15}+\frac{9}{15}+\frac{13}{15}$?   " $2\frac{1}{5}$.
7. What is the sum of $\frac{3}{4}+\frac{1}{3}+\frac{1}{5}+\frac{3}{4}+\frac{1}{6}$?   " $2\frac{1}{5}$.
8. What is the sum of $\frac{2}{5}$ of $\frac{3}{4}+\frac{1}{2}$ of $\frac{1}{4}+\frac{3}{4}$ of $\frac{1}{2}$?   " $\frac{3}{5}$.
9. What is the sum of $\frac{6}{7}$ of $\frac{2}{7}+\frac{3}{7}$ of $\frac{1}{2}+\frac{2}{11}$ of $\frac{1}{3}$?   " $\frac{1681}{3234}$.
10. What is the sum of $1\frac{4}{9}+\frac{1}{4}$ of $\frac{6}{8}+11$?   " $12\frac{173}{288}$.

Note 1. When mixed numbers are given, find the sum of the fractions as before, to which add the integers.

11. What is the sum of $4\frac{1}{2}+7\frac{1}{5}+8\frac{4}{5}$?   *Ans.* $20\frac{19}{30}$.
12. What is the sum of $9\frac{3}{4}+6+8+11\frac{1}{3}$?   " $34\frac{7}{12}$.
13. What is the sum of $\frac{7}{8}+6\frac{3}{11}+14\frac{1}{3}+51\frac{3}{4}$?   " $73\frac{61}{264}$.

Note 2. When the fractions are of different names, find their value by Case VIII. and add as in Compound Addition.

14. What is the sum of $\frac{4}{7}$ shil. $+\frac{3}{11}$ penny? *Ans.* 7d. $\frac{19}{77}$
15. What is the sum of $\frac{4}{11}$£ $+\frac{7}{9}$ shil.? *Ans.* 8s. $1\frac{3}{4}$d. $\frac{1}{11}$
16. Add together $\frac{11}{14}$£, $\frac{6}{7}$ guinea, and $\frac{5}{6}$ shilling ?   *Ans.* £1 14s. $6\frac{1}{2}$d. $\frac{2}{7}$
17. Add together $\frac{3}{5}$d., $\frac{5}{8}$ shilling, $\frac{5}{7}$£, $\frac{7}{8}$ moidore.   *Ans.* £1 18s. 7d. $\frac{1}{35}$
18. Add together $\frac{7}{8}$ cwt. and $\frac{3}{4}$ lb. *Ans.* 3 qr. 14 lb. 12 oz.
19. Add together $\frac{1}{4}$ lb. $\frac{1}{7}$ oz. $\frac{3}{5}$ dwt.   *Ans.* 3 oz. 3 dwt. $10\frac{24}{35}$ gr.
20. Add together $\frac{3}{5}$ qr. $\frac{2}{3}$ bush. and $\frac{3}{4}$ peck.   *Ans.* 5 bush. $2\frac{7}{15}$ pecks.

21. Add together $\frac{2}{3}$ hour, $\frac{5}{12}$ day, and $\frac{4}{7}$ week.

Ans. 4d. 10h. 36m.

22. A person borrowed at one time £36$\frac{5}{8}$, at another time £27$\frac{3}{7}$, at another time 17$\frac{3}{5}$s.: how much did he borrow in all?

Ans. £64 18s. 8d. $\frac{8}{35}$

23. B. went to market and bought 4$\frac{3}{7}$ cwt. + 18$\frac{3}{7}$ lb. + 28$\frac{13}{14}$ lb.+13$\frac{3}{4}$ oz. of tea : how much did he buy in all?

Ans. 544 lb. 10 oz. 9$\frac{5}{6}$ dr.

24. C. went to market and sold 54$\frac{1}{2}$ yards+16$\frac{3}{4}$ yards+ 30$\frac{1}{3}$ ells Eng.+4$\frac{2}{5}$ ells Flem. of cloth: how many yards did he sell in all?   *Ans.* 112 yds. 2 qr. 2 na.

SUBTRACTION OF VULGAR FRACTIONS.

RULE. Having reduced the fractions as in Addition, find the difference of the numerators ; under which write the common denominator.

Note. In mixed numbers, first subtract the fractions, and if the numerator of the subtrahend exceeds that of the minuend, subtract it from the common denominator, and to the remainder add the numerator of the minuend for the numerator of the fraction; and carry one to the units' place of the subtrahend.

From $\frac{4}{7}$ take $\frac{2}{5}$ | From 63$\frac{1}{6}$ take 49$\frac{9}{11}$

$\frac{4}{7} = \frac{20}{35}$ | 63$\frac{1}{6} = 63\frac{11}{66}$

$\frac{2}{5} = \frac{14}{35}$ | 49$\frac{9}{11} = 49\frac{12}{66}$

$\frac{6}{35}$ ans. | 13$\frac{65}{66}$ ans.

1. $\frac{8}{9} - \frac{1}{9}$.   *Ans.* $\frac{7}{9}$. | 4. 7 $-\frac{2}{3}$ of $\frac{3}{4}$.   *Ans.* 6 $\frac{1}{2}$.
2. $\frac{8}{9} - \frac{4}{7}$.   *Ans.* $\frac{20}{63}$. | 5. 4$\frac{1}{7} - \frac{1}{3}$ of $\frac{4}{5}$.   *Ans.* 3$\frac{79}{112}$.
3. $\frac{9}{10} - \frac{2}{5}$.   *Ans.* $\frac{1}{2}$. | 6. 4$\frac{1}{10} - \frac{2}{3}$ of 1$\frac{4}{9}$.   *Ans.* 3$\frac{97}{270}$.

7. From $\frac{3}{4}$ of $\frac{4}{5}$ take $\frac{1}{6}$ of $\frac{7}{10}$.   *Ans.* $\frac{47}{60}$.
8. From 1$\frac{1}{5}$ of $\frac{3}{8}$ take $\frac{2}{3}$ of $\frac{4}{7}$.   *Ans.* $\frac{167}{6 \cdot 5 \cdot 7}$.
9. From 29$\frac{5}{6}$ take 16$\frac{7}{8}$.   *Ans.* 12$\frac{23}{24}$.
10. From 56 take 21$\frac{4}{15}$.   *Ans.* 34$\frac{11}{15}$.
11. From £11$\frac{4}{9}$ take £3$\frac{3}{8}$.   *Ans.* £8 1s. 4$\frac{1}{2}$d. $\frac{2}{3}$
12. From $\frac{4}{7}$ lb. tr. take 3$\frac{4}{9}$ dwt.

Ans. 6 oz. 13 dwt. 16$\frac{16}{21}$ gr.

13. From $\frac{3}{5}$ tons take $\frac{2}{3}$ cwt.   *Ans.* 6 cwt. 3 qr. 16$\frac{4}{5}$ lb.
14. From 8$\frac{4}{5}$ acres take 3$\frac{5}{6}$ roods.   *Ans.* 7 a. 3 r. 25$\frac{7}{9}$ per.
15. Paid a debt of 7$\frac{4}{11}$ pounds out of a purse containing 9$\frac{1}{12}$ guineas: how much remained ?   *Ans.* 43s. 5$\frac{1}{2}$d. $\frac{10}{11}$
16. A.'s share of a ship was $\frac{27}{38}$, of which he sold $\frac{3}{4}$: how much remained ?   *Ans.* $\frac{27}{152}$.

17. A person who had 13⅝ yards of cloth, sold 7¾ yards: how much remained ? *Ans.* 5⅞.

18. What part of a ship remained after selling ¼ of ⅝+⅕ of ³⁄₇ ? *Ans.* 3⁹⁄₇₀.

19. Sold ⅔ of ⅚+⅔ of ³⁄₇ of a gallon of wine : what part remained ? *Ans* 4⁵⁄₁₁₂.

20. What number is that to which if ²⁄₇ of ⅝ be added, the sum will be 1 ? *Ans.* 5³⁄₆₃.

21. What number is that to which if you add 7⅔, the sum will be 12¼ ? *Ans.* 4⁷⁄₁₂.

MULTIPLICATION OF VULGAR FRACTIONS.

RULE.—Multiply all the numerators together for the numerator of the product : and all the denominators together for its denominator.

Note. In Multiplication and Division, reduce integers and mixed numbers to improper fractions.

Mult. ¾ by ⁵⁄₇. | Mult. 8½ by 5¾.

$\frac{3}{4} \times \frac{5}{7} = \frac{15}{28}$ ans. | $\frac{17}{2} \times \frac{23}{4} = \frac{391}{8} = 48\frac{7}{8}$ ans.

1. What is the product of ¾ and ⅝ ? *Ans.* ⁹⁄₃₂.

2. What is the product of ⅞ of ¾, and ⁵⁄₉ ? *Ans.* ⁷⁄₁₂.

3. What is the product of 5, and ⁶⁄₁₅ of 1¹⁄₄ ? *Ans.* 5½.

4. Multiply 7¼ by ⁹⁄₁₀ of ⁴⁄₇ of 10. *Ans.* 37⁴⁄₇.

5. Multiply ⅔ of 7½, by ²⁄₇ of ⅞ of 1½. *Ans.* 1²⁵⁄₃₂.

6. Multiply ⅓ of ⅔ of ¾, by 1⅓ of 3⅕ of 11. *Ans.* 6⁷⁴⁄₁₀₃.

7. Multiply 7⅞, 4⅓, 9¹⁄₀, and 9¹⁄₁₁. *Ans.* 2895⁵⁄₁₁.

8. Multiply 3⅓, ⅞ of 5⅔, 9³⁄₁₀, and 3⅔ of ⅑. *Ans.* 62.

9. What is the value of 20¾ bolls barley, at 26s. 8d. ? *Ans.* £27 13s. 4d.

10. What is the value of 3⁷⁄₁₅ yards, at 21s. 3d. per ell Eng.? *Ans.* £2 18s. 5¼d.

11. What is the value of ⅝ yard cloth, at £1⁷⁄₁₈ per yard ? *Ans.* 11s. 9½d. ⅔.

12. What is the value of ³⁄₇ acre, at £2³⁄₁₁ per acre ? *Ans.* 19s. 5¾d. ⁵⁄₇.

13. What is the value of 17⁵⁄₁₁ yards, at 7⁵⁄₁₈s. per yard ? *Ans.* £6 7s. 0¼d. ⁵⁄₇.

14. What is the value of 37⅔ ells Eng. at 5¾d. per yard ? *Ans.* £1 1s. 3d. ⅐

15. What is the value of ⁵⁄₇ oz. silver, at £3⅝ per lb. ? *Ans.* 4s. 3¾d. ⅐

16.   What is the value of $60\frac{3}{5}$ gal. at 7s. 4d. $\frac{3}{10}$ per gallon?
                                    Ans. £22 5s. $10\frac{3}{4}$d. $\frac{22}{25}$

17.   What is the value of 4 cwt. 3 qr. 14 lb. at 72s. $8\frac{1}{2}$d.
per cwt.?   *Ans.* £17 14s. $5\frac{1}{4}$d. $\frac{3}{4}$

DIVISION OF VULGAR FRACTIONS.

RULE.—Invert the divisor, and proceed as in Multiplication.

Divide $\frac{7}{8}$ by $\frac{4}{5}$.	Divide $5\frac{1}{2}$ by $2\frac{3}{5}$.
$\frac{7}{8} \times \frac{5}{4} = \frac{35}{32} = 1\frac{3}{32}$ ans.	$\frac{11}{2} \times \frac{5}{13} = \frac{55}{26} = 2\frac{3}{26}$ ans.

1. $\frac{3}{4} \div \frac{6}{11}$.   *Ans.* $\frac{11}{14}$.
2. $\frac{5}{11} \div \frac{2}{3}$.   *Ans.* $\frac{15}{22}$.
3. $\frac{4}{9} \div \frac{3}{4}$.   *Ans.* $\frac{16}{27}$.
4. $\frac{6}{7} \div \frac{3}{8}$.   *Ans.* $2\frac{2}{7}$.
5. $\frac{1}{2}$ of $\frac{1}{3} \div \frac{6}{7}$.   *Ans.* $\frac{7}{24}$.
6. $\frac{3}{4} \div \frac{1}{3}$ of $\frac{1}{2}$.   *Ans.* $4\frac{1}{2}$.

7. $\frac{11}{13} \div 8$.   *Ans.* $\frac{11}{120}$.
8. $29 \div \frac{3}{4}$.   *Ans.* $38\frac{2}{3}$.
9. $\frac{3}{8} \div 5\frac{1}{2}$.   *Ans.* $\frac{3}{44}$.
10. $76\frac{1}{2} \div 36\frac{4}{5}$.   *Ans.* $2\frac{47}{512}$.
11. $\frac{1}{4}$ of $\frac{1}{2} \div \frac{2}{3}$ of $\frac{1}{2}$.   *Ans.* $\frac{3}{8}$.
12. $\frac{2}{5}$ of $7\frac{3}{4} \div \frac{1}{9}$ of 4.   *Ans.* $6\frac{39}{40}$.

13.   If $7\frac{5}{7}$ yards of lawn cost $38\frac{7}{8}$s.: what is the price per yard?   *Ans.* 5s. $0\frac{1}{4}$d. $\frac{6}{9}$

14.   A farm of $17\frac{8}{11}$ acres was rented at £$14\frac{7}{15}$: what was the rent per acre?   *Ans.* 16s. $3\frac{3}{4}$d. $\frac{83}{195}$

15.   What is cloth per yard, when 7 pieces, each $11\frac{3}{5}$ yards. cost £$54\frac{3}{8}$?   *Ans.* 13s. $4\frac{1}{4}$d. $\frac{6}{7}$

16.   A man performed a piece of work in $6\frac{13}{18}$ days: what part of the work did he perform in 1 day?   *Ans.* $\frac{18}{121}$ per day.

17.   How many stones, each $13\frac{4}{5}$ inches by $7\frac{1}{4}$, will lay a kitchen floor $40\frac{7}{9}$ feet long, and $32\frac{3}{4}$ broad?
                                    Ans. $1926\frac{468}{667}$ stones.

18.   Divide a ship of £$980\frac{7}{11}$ value into $21\frac{3}{7}$ shares, and a prize of £1000 value into $42\frac{5}{8}$ shares.
           Ans. £45 15s. 3d. $\frac{7}{55}$, and £23 9s. $2\frac{1}{4}$d. $\frac{339}{341}$

19.   Divide £160 16s. 8d. among A. B. C. and D., so that A. B. and C. may have equal shares, and D. $\frac{3}{5}$ of one of their shares.
Ans. A. B. and C. each £44 13s. 6d. $\frac{2}{9}$, and D. £26 16s. 1d.$\frac{1}{3}$

PROPORTION OF VULGAR FRACTIONS.

RULE.—State the terms as in integers, and multiply and divide as directed above.

1.   If $\frac{3}{4}$ of a pound cost $\frac{7}{12}$ of a shilling: what will $\frac{13}{16}$ of a lb. come to?   *Ans.* $7\frac{1}{4}$d. $\frac{1}{3}$

2.   If $\frac{7}{8}$ of a yard cost 12s. 9d.: how much will $2\frac{5}{8}$ yards come to?   *Ans.* £1 18s. 3d.

3. If $\frac{3}{4}$ of a pound cost 5s. 6d.: what will $42\frac{3}{8}$ lbs. of the same cost?   *Ans.* £15 10s. 9d.

4. If $6\frac{1}{2}$ yards cost 18s.: what will $9\frac{1}{4}$ yards come to?
                                                   Ans. £1 5s. $7\frac{1}{4}$d. $\frac{7}{13}$

5. What will be the price of $7\frac{1}{2}$ cwt. sugar, when $\frac{9}{10}$ of a cwt. cost £3 11s. 8d.?   *Ans.* £29 17s. $2\frac{1}{2}$d. $\frac{2}{3}$

6. If $2\frac{7}{8}$ yards, which is $1\frac{3}{4}$ yard broad, will make a suit of clothes: how many yards will it take of $1\frac{1}{8}$ yard wide?
                                                   Ans. $4\frac{17}{36}$ yards.

7. What will $\frac{17}{19}$ of a cwt. cost, at £10 4s. 9d. per fodder of $19\frac{1}{2}$ cwt.?   *Ans.* 9s. $4\frac{1}{2}$d. $\frac{18}{19}$

8. If $\frac{7}{8}$ gallon of rum cost 13s. $6\frac{1}{2}$d.: what will $9\frac{1}{4}$ gallons cost?   *Ans.* £7 3s. $1\frac{3}{4}$d. $\frac{3}{7}$

9. If the value of $\frac{3}{7}$ of a ship be £$921\frac{1}{4}$: what will $\frac{5}{9}$ come to?   *Ans.* £1194 4s. 3d. $\frac{1}{0}$

10. A friend lent me £$454\frac{3}{5}$ for $6\frac{1}{8}$ months: how long must I lend him £$204\frac{1}{5}$ to discharge the obligation?
                                          Ans. 13m. $19\frac{209}{4084}$ days.

11. Bought $\frac{7}{8}$ of a ship, and sold $\frac{3}{4}$ of my share for £300 17s. 6d.: what is the value of the ship?
                                          Ans. £458 9s. $6\frac{1}{4}$d. $\frac{1}{7}$

12. If 2 men mow $\frac{3}{4}$ of an acre in $\frac{2}{3}$ of a day: how many acres will 6 men mow in $3\frac{1}{3}$ days?   *Ans.* $11\frac{1}{4}$ acres.

13. If 4 men can finish $12\frac{3}{4}$ roods of ditching in $3\frac{1}{4}$ days: how many roods can 18 men do in $14\frac{9}{17}$ days?
                                                   Ans. $256\frac{1}{2}$ roods.

14. If a regiment of soldiers, consisting of 975 men, use $17\frac{3}{4}$ quarters of wheat in $\frac{1}{36}$ of a month: how many soldiers will 71 quarters serve $2\frac{1}{19}$ months?   *Ans.* 50 soldiers.

15. If 264 men, in $5\frac{3}{4}$ days of $11\frac{1}{4}$ hours long, do a piece of work: in how many days of $9\frac{1}{2}$ hours long, will 30 men do the same?   *Ans.* $59\frac{35}{36}$ days.

DECIMAL FRACTIONS.

1. A *Decimal Fraction* is always a unit, with one or more ciphers for its denominator; as $\frac{7}{10}, \frac{76}{100}, \frac{325}{1000}$.

2. The numerator *only* in decimals is expressed; the denominator being always 1, with as many ciphers as there are figures in the numerator.

3. Decimals are distinguished from whole numbers by a point on the left of them; thus, ·5 stands for $\frac{5}{10}$, ·75 for $\frac{75}{100}$, ·245 for $\frac{245}{1000}$, and ·4356 for $\frac{4356}{10000}$.

4. A mixed number is when there are figures both on the right and left of the point ; those on the left are whole numbers and those on the right are decimals ; thus 27·41, 345·84.

5. Ciphers on the right of decimals do not alter their value, but being placed on the left of them, with a point prefixed, decrease the value in a tenfold proportion.

6. A *Terminate* or *Finite decimal* is one which extends only to a limited number of places, as ·5, ·125, &c.

7. *Interminate decimals* are those which extend *ad infinitum*, and are called *repeaters*, when they always repeat the same figure, as, ·3333, &c., and *circulates*, when two or more figures are continually repeated, as, ·424242, ·42394239, &c.

The notation of decimals will appear from this table.

7	6	5	4	3	2	1 .	1	2	3	4	5	6
Millions.	Hund. of thous.	Tens of thousands.	Thousands.	Hundreds.	Tens.	Units.	Tenth parts.	Hundredth parts.	Thousandth parts.	Ten thous. parts.	Hund. thous. parts.	Millionth parts.

Note. From the above table, it appears that decimals decrease in the same tenfold proportion towards the right hand, that whole numbers increase towards the left.

To express any decimal in words.

RULE.—Put 1 with as many ciphers as there are figures in the decimal for a denominator ; then express in words what that fraction is, which will be the value of the decimal.

Express in words ·5— 3·4 —·07 —·453 —·025 —·066 —·2587— ·0074—·40612—·00050—·384051—·007006—·0000508.

To express any decimal fraction in figures.

RULE.— Express it in the form of a vulgar fraction ; then if the numerator consists of as many places as there are ciphers in the denominator, set it down with a point on the left of it. But if the numerator have not a sufficient number of places, ciphers, with a point on the left of them, must be prefixed to supply the defect.

Express in figures — three tenths — twenty-five hundredth parts — seventy-five hundredth parts — five hundredth parts — sixty-seven thousandth parts — one hundred and forty-nine hundred thousandth parts — twenty-nine ten thousandth parts

— two thousandth parts — one hundred and four thousandth parts — seventeen hundredth parts — ninety-five millionth parts —one thousand three hundred and fourteen millionth parts.

ADDITION OF DECIMALS.

RULE—Place down the numbers in such a manner that tenths may be under tenths, hundredths under hundredths, &c., in which order the decimal points will stand directly under one another; and then add as in whole numbers, and put a point in the sum directly under the other points.

·34	54·517
·7546	5·86
·08034	·0748
·9	63·4
·653	8·00754
·00719	92·
·7405	7·794
3·47563 sum.	231·65334 sum.

1. What is the sum of ·6158+·721+·03142+·53+·943805 +·83?

2. Add together ·07431 + ·84 + ·3072 + ·003185 + ·618 + ·407039.

3. Required the sum of 45·72+820·406+·370472+5436·8+ 50·0751+638·714+4·000725.

4. What is the sum of 34·5146+8503·07+·00348+380·874 +7436+5·7056+73·08+4·53089 ?

5. Add ·5408+·75+8·025+72·42+940·1368+56+7·874+ 83·6075+·28.

6. Required the sum of eighteen hundredth parts—seven hundred and forty-five hundred thousandth parts — nine thousandth parts — forty-three millionth parts — five hundred and eight thousandth parts—one hundred and thirty-two thousandth parts — one thousand and forty-four ten millionth parts — twenty-five hundredth parts—five tenths—and six hundred and five thousandth parts.

SUBTRACTION OF DECIMALS.

RULE.—Place the numbers as in addition ; then subtract as in whole numbers.

From ·83052610	From 74·03594
Take ·74308749	Take 8·6382
·08743861	65·39774

1. What is the difference between 83·1496 and 7·38068?
2. What is the difference between ·54163 and 5·124?
3. What is the difference between 700·41 and 98·05769?
4. What is the difference between 1·53376 and 9·64?
5. What is the difference between 6·1 and ·007439?
6. What is the difference between seven hundred and fifty-five thousandth parts and ninety-nine thousandth parts?
7. 83·149 + 6·5307 + 904·072 + 81·40536 + 1052·74 − 394·5196.
8. 7·385 + 91·74 + 8·0726 + 35·63 + 2·475 − 34·173 + 63·749351.

MULTIPLICATION OF DECIMALS.

RULE.—Multiply as in whole numbers, and point off in the product as many decimals as there are in both multiplicand and multiplier; but if the product does not contain as many figures, supply the defect by ciphers on the left.

Multiply 23·416 by 6·43	Multiply ·51437 by ·0175
6·43	·0175
70248	257185
93664	360059
140496	51437
150·56488 ans.	·009001475 ans.

1. Multiply 617·42 by   3·26?   *Ans.* 2012·7892.
2. Multiply ·2764 by   96?   *Ans.* 26·5344.
3. Multiply   174 by   ·149?   *Ans.* 25·926.
4. Multiply 62·348 by ·00172?   *Ans.* ·10723856.
5. Multiply   ·0783 by   ·461?   *Ans.* ·0360963.
6. Multiply   ·06948 by ·0087?   *Ans.* ·000604476.
7. Multiply ·001038 by   ·77?   *Ans.* 00079926.
8. Multiply ·078446 by 398000.
9. Multiply ·000798 by 109700.

Note. To multiply by a unit with ciphers, remove the decimal point as many places towards the right hand as there are ciphers.

7432·65 × 100.—16385·43 × 1000.—7436·134 × 10000.

DIVISION OF DECIMALS.

RULE.—Divide as in whole numbers, and point off as many decimals in the quotient as the dividend has more than the divisor; but if there be not as many places in the quotient, put ciphers on the left to supply the defect; and if the dividend has

not as many places of decimals as the divisor, annex ciphers till they are equal; or, by annexing ciphers continually thereto, the division may be prolonged till nothing remain, till the quotient circulate, or as far as may be judged necessary.

·23)·7935(3·35	2·3)·7935(·345	23)·7935(·0345
69	69	69
103	103	103
92	92	92
115	115	115
115	115	115

1.	Divide	7·935 by	·23.	*Ans.* 34·5.
2.	Divide	79·35 by	·23.	*Ans.* 345.
3.	Divide	793·5 by	·23.	*Ans.* 3450.
4.	Divide	7935· by	·23.	*Ans.* 34500.
5.	Divide 417·8125 by	37·5.		*Ans.* 11·1416.
6.	Divide	37·25 by	281·5.	*Ans.* ·1323268 $\frac{116}{563}$.
7.	Divide	219·75 by	124.	*Ans.* ·00177217 $\frac{23}{31}$.
8.	Divide	·5 by ·00725.		*Ans.* 68·965517 $\frac{7}{29}$.

· *Note* 1. When the divisor is an integer with any number of ciphers annexed; cut off the ciphers and remove the decimal point in the dividend as many places farther to the left as there are ciphers cut off, prefixing ciphers if necessary, then proceed as before.

1.	8463·7÷2300.	3.	10·4639÷1000.
2.	4738·37÷463000.	4.	94·687÷874000.

Note 2. To divide by a unit with ciphers, remove the decimal point as many places towards the left hand as there are ciphers.

7436·5÷100—3817·42÷1000—20472·16÷10000.

REDUCTION OF DECIMALS.

CASE I. To reduce a vulgar fraction to a decimal.

RULE. Annex ciphers to the numerator as decimals, and then divide it by the denominator; if there be not so many figures in the quotient as there were ciphers annexed, supply the defect by writing ciphers before it.

Reduce $\frac{7}{8}$ to a decimal.	Reduce $\frac{1}{400}$ to a decimal.
8)7·000	400)1·0000
·875 ans.	·0025 ans.

Reduce each of the following fractions to a decimal.

1. $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{7}$, $\frac{1}{8}$, and $\frac{1}{9}$.
2. $\frac{2}{3}$, $\frac{3}{8}$, $\frac{5}{8}$, $\frac{5}{6}$, $\frac{7}{8}$, and $\frac{9}{10}$.
3. $\frac{7}{168}$.   *Ans.* ·0416
4. $\frac{48}{79}$.   *Ans.* ·6075949+
5. $\frac{6}{159}$. *Ans.* ·037735849+
6. $\frac{1}{2}$ of $\frac{3}{4}$.   *Ans.* ·375.

7. $\frac{2}{3}$ of $\frac{3}{4}$.   *Ans.* ·5.
8. $\frac{2}{3}$ of $\frac{1}{2}$.   *Ans.* ·3.
9. $\frac{1}{3}$ of $\frac{5}{6}$.   *Ans.* ·175.
10. $\frac{1}{16}$ of $\frac{9}{10}$. *Ans.* ·05625.
11. $\frac{7}{800}$.   *Ans.* ·00875.
12. $\frac{3}{250}$.   *Ans.* ·012.

CASE II.   To reduce a decimal to a vulgar fraction.

RULE.   Make the given decimal the numerator, and a unit,
with as many ciphers annexed as there are figures in the deci-
mal, the denominator of the required fraction, which reduce to
its lowest terms.

    1.   Reduce ·5 to a vulgar fraction. $\frac{5}{10} = \frac{1}{2}$ ans.
    2.   ·25. | 4.   ·125. | 6.   ·34. | 8.   ·005.
    3.   ·75. | 5.   ·625. | 7.   .375. | 9.   ·078.

CASE III.   To reduce numbers of a larger name to the deci-
mal of a higher.

RULE.   If the given number be simple, annex ciphers, and
divide by as many of that name as make one of the higher;
but if it be compound, begin at the lowest and reduce it to the
next higher name; to this decimal prefix the next higher deno-
mination, reduce this decimal to the next higher, and so on to
the required decimal.

Reduce 13s. 8¼d. to the deci- | Reduce 7 oz. 5 dwt. 12 gr. to
  mal of a £. | the decimal of a lb.
    4) 1·00 | 24)12·0

   12) 8·25 | 20) 5·5

  20)13·0875 | 12) 7·275

    ·684375 ans. | ·60625 ans.

The questions in this case and the next prove each other.

1.   Reduce 9d. to the decimal | 8.   Reduce 8lb. to the deci-
  of a pound. | mal of a cwt.
2.   17s. 6d.   pound. | 9.   11 oz. 17 dwt.   lb.
3.   12s. 8¼d.   pound. | 10. 5 dwt. 12 gr.   oz.
4.   7s. 6¾d.   pound. | 11. 7 oz. 14 dr.   cwt.
5.   4½d.   pound. | 12. 10 oz. 12 dr.   lb. av.
6.   ¾d.   pound. | 13. 3 oz. 14 dwt. 8 gr. lb.
7.   7 lb.   cwt. | 14. 3 qrs.   yard.

15. Reduce 1 qr. 2 na. to the decimal of a yard.

16. 6 fur. 5 po.   mile.

17. 2 ro. 11 per.   acre.

18. 7½d.   shil.

19. Reduce 4 bus. 3 p. 1¼ gr. to the decimal of a qr.

20. 22 m. 3 sec.   hour.

21. 1 ro. 22 per.   acre.

22. 3 d. 12 ho.   yea...

CASE IV. To find the value of a decimal.

RULE. Multiply it by the number of times the integer contains the next lower name, and point off as many decimals from the product, towards the right hand, as there are in the given decimal ; the figures in the left hand are integers of said lower name ; reduce the figures pointed off in the next lower name, and point off as before.

What is the value of
£ ·684375
20
————
s. 13·687500
12
————
d. 8·250000
4
————
far. 1·000000
————
13s. 8¼d. ans.

What is the value of
lb. ·60625 troy.
12
————
oz. 7·27500
20
————
dwt. 5·50000
24
————
gr. 12·00000
————
7 oz. 5 dwt. 12 gr. ans.

What is the
1. value of £·0375
2. value of £·875
3. value of £·634375
4. value of £·378125
5. value of £·01875
6. value of £·003125
7. value of .0625 cwt.
8. value of ·071428 cwt.
9. value of ·9875 lb. troy.
10. value of ·275 oz. troy.
11. value of ·004394 cwt.

What is the
12. value of ·671875 lb. av.
13. value of ·30972 lb. troy.
14. value of ·75 yard.
15. value of ·375 yard.
16. value of ·765625 mile.
17. value of ·56875 acre.
18. value of ·625 shil.
19. value of ·61328125 qr.
20. value of ·3675 hour.
21. value of ·3875 acre.
22. value of ·009589 year.

Note. The two following contractions are of great *practical utility* in decimal calculations ; as they approximate sufficiently near the truth, and so simple that they can be performed mentally.

1. To reduce shillings, pence and farthings, to the decimal of a £.

Rule. Take half the number of shillings for the first decimal place ; and the number of farthings in the remainder, increased by 1 if it amount to 24 or upwards, by 2 if it amount to 48 or upwards, and by 3 if to 72 or upwards, will give the two next places.

			Reduce mentally to the decimal of a £.		
1.	2s.	6d. =·125	1. 4s. 6d.	6. 14s. 3d.	11. 0s. 7¼d.
2.	14s.	9d. =·737	2. 7s. 6d.	7. 16s. 6d.	12. 0s. 8¾d.
3.	7s.	1¾d.=·357	3. 17s. 9d.	8. 19s. 1d.	13. 1s. 10¼d.
4.	1s.	11¼d.=·096	4. 8s. 7¾d.	9. 1s. 2¼d.	14. 4s. 9½d.
5.	12s.	1½d.=·606	5. 18s. 5¼d.	10. 3s. 7½d.	15. 11s. 4¾d.

II.   To find the value of a decimal of a £ mentally.

Rule.   Double the first figure for *shillings*, to which add 1s. when the second figure is 5 or more ; then account the second and third figures (when they do not amount to 50, or their excess above 50, when they do) to be *farthings*, after having deducted 1 for every 25 in their number.

			Value mentally these decimals of a £.		
1.	·825 =	16s. 6d.			
2.	·207 =	4s. 1¾d.	1. ·403	5. ·75	9. ·005
3.	·95 =	19s. 0d.	2. ·513	6. ·463	10. ·034
4.	·681 =	13s. 7½d.	3. ·739	7. ·578	11. ·083
5.	·043 =	0s. 10½d.	4. ·841	8. ·795	12. ·09

Note. The pupil should now work by decimals, all the practical questions given under the rules of Addition, Subtraction, Multiplication, Division, and Proportion of Vulgar Fractions.

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CIRCULATING DECIMALS.

1.   A repeating or circulating decimal is when one or more figures are continually repeated.

2.   A single repeater is when one figure continually repeats ; as ·666—·333, and are marked thus 6̇, 3̇.

3.   A compound repeater is when two or more figures continually repeat ; ·42 42,—·617617 ; marked thus ·4̇2̇,—·6̇17̇.

4.   A mixed repeater is that which has other figures in it besides those which are repeated ; as ·28333,—5·2321321, and marked thus ·283̇—5·232̇1̇.

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REDUCTION OF CIRCULATING DECIMALS.

1.   To reduce a single or compound repeater to a vulgar fraction.

RULE. Make the given decimal the numerator, and as many 9s. as there are figures in the given decimal, the denominator; which reduce to its lowest terms.

Reduce ·3 to a vulgar fraction.	Reduce ·27 to a vulgar fraction.	Reduce ·063 to a vulgar fraction.
$\frac{3}{9}=\frac{1}{3}$ ans.	$\frac{27}{99}=\frac{3}{11}$ ans.	$\frac{063}{999}=\frac{7}{111}$ ans.

Reduce the following circulates to vulgar fractions.

1.	·i̇.	*Ans.* $\frac{1}{9}$	5.	·3ẏ6̇.	*Ans.* $\frac{4}{11}$	9.	·962̇.	*Ans.* $\frac{26}{27}$
2.	·6̇.	*Ans.* $\frac{2}{3}$	6.	·9ẏ0̇.	*Ans.* $\frac{10}{11}$	10.	·14634̇.	*Ans.* $\frac{6}{41}$
3.	·2̇.	*Ans.* $\frac{2}{9}$	7.	i̇08̇.	*Ans.* $\frac{4}{37}$	11.	·615384̇.	*Ans.* $\frac{8}{13}$
4.	·7̇.	*Ans.* $\frac{7}{9}$	8.	i̇48̇.	*Ans.* $\frac{4}{27}$	12.	·857142̇.	*Ans.* $\frac{6}{7}$

II. To reduce a mixed repeater to a vulgar fraction.

RULE. Subtract the finite part from the whole, the remainder is the numerator, and for the denominator, place 9 for every repeating figure, with a cipher annexed for every finite place.

Reduce ·340ẏ9̇ to a vulgar fraction.	Reduce ·44642857i̇ to a vulgar fraction.
340ẏ9̇	44642857i̇
34	446
————	—————————
3375	446428125
———— $=\frac{45}{132}$ ans.	————————— $=\frac{25}{56}$ ans.
9900	999999000

Reduce the following mixed circulates to vulgar fractions.

1.	·008̇3̇	*Ans.* $\frac{1}{120}$.	6.	·254629̇	*Ans.* $\frac{55}{216}$.
2.	·i̇6̇	*Ans.* $\frac{1}{6}$.	7.	·0795̇4̇	*Ans.* $\frac{7}{88}$.
3.	·0i̇85̇	*Ans.* $\frac{1}{54}$.	8.	·762195̇i̇	*Ans.* $\frac{125}{164}$.
4.	·83̇	*Ans.* $\frac{5}{6}$.	9.	·568̇i̇	*Ans.* $\frac{25}{44}$.
5.	·416̇	*Ans.* $\frac{5}{12}$.	10.	·0324̇8̇	*Ans.* $\frac{649}{19980}$.

ADDITION OF CIRCULATING DECIMALS.

I. When they are single repeaters.

RULE. Extend the repeating figures one place beyond the longest finite decimal, and carry at 9 in the right hand column.

II. When they are compound repeaters.

RULE. Extend the repeating figures till they become similar, and when you add the right hand column, include what would have been carried, if the repeaters had been extended further.

Add together 45·3̇+3·6̇+
  14·25̇3̇+·4625.

$$
\begin{aligned}
45·\dot{3} &= 45·\dot{3}3333 \\
3·\dot{6} &= 3·66666 \\
14·2\dot{5}\dot{3} &= 14·25333 \\
·4625 &= ·4625 \\
\hline
 & 63·7158\dot{3}
\end{aligned}
$$

Add 30·62̇08̇5+6·302̇8̇
  29·00642̇+365·6̇

$$
\begin{aligned}
30·6\dot{2}0852\dot{0} & \quad {}_{8520} \\
6·302\dot{8}28\dot{2} & \quad {}_{8282} \\
29·006424\dot{2} & \quad {}_{4242} \\
365·\dot{6}66666\dot{6} & \quad {}_{\frac{6666}{7712}} \\
\hline
431·5967712 &
\end{aligned}
$$

1. Add together ·381̇3̇+·4̇2̇+·521̇6̇+·9472̇4̇.

    Ans. 2·27246̇

2. Add ·8̇3̇+7·41̇6̇+·31855+6·2̇5+4·3̇8+29·62̇7.

    Ans. 48·835216̇.

3. Add 210·3̇+194·2̇1̇+85·074̇3̇+900.08165.

    Ans. 1389·700427̇.

4. Add 8·203̇8̇+9·0468̇+7·3654̇8̇+43·468̇3̇.

    Ans. 68·084577̇.

5. Add 30·62̇08̇5+6·302̇8̇+29·00642̇+365·6̇.

    Ans. 431·5967712̇.

6. Add 81·0048̇16̇4+3·2̇05̇×5·07426̇+5·8̇5̇.

    Ans. 95·1427̇20̇2̇.

7. Add 39·0034̇+6·0526̇+82·082578̇+9·5218̇.

    Ans. 136·66046697̇1̇.

SUBTRACTION OF CIRCULATING DECIMALS.

I. To subtract single repeaters.

RULE. Extend the repeaters one place beyond the longest finite part, and borrow 9 at the right hand figure when necessary.

II. To subtract circulates.

RULE. Make the circulates similar as in Addition, and if the first figure in the subtrahend on the right of the longest finite part be greater than the one above it, add 1 to the right hand figure of the subtrahend before subtracting.

From 57·2̇5̇
Take 49·16̇6̇

8·08̇3̇

From 32·50̇2̇76̇2762762762
Take 26·042̇687̇568756875

6·460̇075̇194005887̇

1.	From 69·3135	take 37·3̇	*Ans.* 31·98016̇.
2.	From 69·41̇6̇	take 25·375	*Ans.* 44·0416̇.
3.	From 931·3824	take 38·6̇	*Ans.* 892·71573̇.
4.	From 562·871̇	take 3·49683̇	*Ans.* 559·37427̇.
5.	From 450·811̇6̇	take 8·58̇	*Ans.* 442·2227̇.
6.	From 81·7175	take 73·561̇	*Ans.* 8·1559384̇.
7.	From 34·851̇	take 5·47325	*Ans.* 29·37860185̇.
8.	From 21·453̇	take 13·72̇	*Ans.* 7·726180̇.
9.	From 92·3846̇	take 18·674371̇	*Ans.* 73·710275093̇.
10.	From 32·78264̇	take 27·85735̇	*Ans.* 4·9252947.

MULTIPLICATION OF CIRCULATING DECIMALS.

I. When the multiplicand is a repeater or circulate.

RULE. When a repeater, carry at 9 on the right of each product, and add as directed for repeaters : when a circulate, to the product on the right hand figure of each line, add the carriage that would have arisen, had the circulate been extended further ; and make the circulates similar before you add them.

Multiply 879·83̇ by ·721	Multiply 586·1635̇ by 827.
879·83̇	586·1635̇—635
·721	827·
———	———
87983	41031449̇
1759666̇	117232712
61588333	4689308508
———	———
634·35983̇	484757·2670̇

1.	Multiply 63·41̇6̇	by 32·5	*Ans.* 2061·0416̇.
2.	Multiply 5·683̇	by 475	*Ans.* 2699·583̇.
3.	Multiply ·49838̇	by 12.64	*Ans.* 6·299635̇.
4.	Multiply 365·481̇	by ·00325	*Ans.* 1·18781590̇.
5.	Multiply ·271̇85̇	by 1.426	*Ans.* ·38766074̇.
6.	Multiply ·92937̇	by 1500	*Ans.* 1394·069̇.

II. When the multiplier is a repeater or circulate.

RULE. Reduce the multiplier to a vulgar fraction ; then multiply by the numerator and divide by the denominator.

Mult. 157·525 by ·4$\dot{6}$ | Mult. 47·571$\dot{8}\dot{5}$ by ·910$\dot{8}$

```
              7        4                        9
           ───────    ──              47·5718̇5̇        ───
        )5)1102675   42— 7                   337    9099—337
   15  {  ───────                    ───────         ───────
        )3) 220535   90—15          370)             9990—370

            73·5116̇ ans.                  43·3289̇56̇ ans.
```

1.	Multiply 92·2$\dot{5}$	by ·$\dot{3}$	*Ans.* 30.751$\dot{8}$.
2.	Multiply 8·09756	by ·$\dot{6}$	*Ans.* 5·39837̇.
3.	Multiply 68·285714̇ by 6·1375̇		*Ans.* 419·106̇1347̇.
4.	Multiply 1725·175	by 6·437̇5̇	*Ans.* 11105·878821̇3̇.

DIVISION OF CIRCULATING DECIMALS.

I. When the dividend only has a repeater or circulate.

RULE. Divide as in finite decimals, but annex the repeating figures instead of ciphers, in order to carry on the division.

II. When the divisor is a repeater or circulate.

RULE. Reduce it to a vulgar fraction; then multiply by the denominator and divide by the numerator.

```
   7·5)39·86̇(5·315̇             Divide 5·37 by ·7̇3̇
       375                                    7
       ───                                  ───
       236                                 66—11
       225                                  ──  ──
       ───                        5.37     90—15
       116                         15
        75                        ───
       ───               11)80.55
       416                        ───
       375
       ───                   7·3227̇ ans.
        41
```

1.	Divide 4.1966$\dot{2}$ by 37		*Ans.* ·1134$\dot{2}$.
2.	Divide 73·416̇	by 6·25	*Ans.* 11·746̇.
3.	Divide 169·$\dot{3}$	by 0·5	*Ans.* 3386·6̇.
4.	Divide 315·625	by 11·5$\dot{3}$	*Ans.* 27·366329+
5.	Divide 6129.5	by ·952$\dot{5}$	*Ans.* 6434.8155737+
6.	Divide 379.37$\dot{5}$	by ·35$\dot{2}$	*Ans.* 1076·693693+

MISCELLANEOUS EXERCISES IN VULGAR AND DECIMAL FRACTIONS.

1. What cost $22\frac{1}{2}$ cwt. sugar, at £$4\frac{5}{16}$ per cwt.?
Ans. £97 0s. 7$\frac{1}{2}$d.

2. Borrowed £$\frac{7}{8}$, and repaid $\frac{2}{5}$ of a guinea: how much is still due? *Ans.* 9s. 1·2d.

3. Whether is £$\frac{41}{320}$, or £·128125 of greater value?
Ans. Equal.

4. Bought a penknife for £·225: how many shillings did it cost me? *Ans.* 4s. 6d.

5. Bought a hat for £$\frac{3}{4}$, and sold it for £·875: whether did I gain or lose, and how much? *Ans.* 2s. 6d. gained.

6. Suppose I buy $\frac{1}{8}$ of a ship, and sell $\frac{3}{4}$ of my share: what part have I left? *Ans.* $\frac{1}{32}$.

7. What number divided by $3\frac{1}{4}$ of 7, will give 20?
Ans. 455.

8. A ship owner sold $\frac{1}{4}$ of $\frac{2}{3}$ of a vessel to one person, and $\frac{6}{7}$ of $\frac{5}{6}$ to another person: what part had he remaining?
Ans. $\frac{157}{420}$.

9. A lady's fortune was $\frac{4}{5}$ of $\frac{7}{8}$ of her brother's, which was valued at £3000: what was the lady's fortune?
Ans. £2100.

10. What is the greatest common measure of $\frac{364}{1268}$?
Ans. 4.

11. Bought 3·5 yards of cloth for £2 14s. 3d.: what must I give for 27·75 yards? *Ans.* £21 10s. 1$\frac{1}{2}$d.

12. Bought $\frac{7}{8}$ of a ship at one time, and $\frac{1}{16}$ of it at another, and being now determined to buy all the ship: required how much I have to pay for? *Ans.* $\frac{1}{16}$.

13. A person left $\frac{2}{3}$ of his estate to his eldest son, $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ to his other son, and the rest to his relations; the eldest son's share was worth £607$\frac{9}{10}$: what was the value of the estate, and what did the youngest son and relations receive?
Ans. £911 17s. value of estate, £227 19s. 3d. to
youngest son, £75 19s. 9d. to relations.

14. Jane can spin a certain quantity of yarn in 12 days, and Margaret an equal quantity in 16 days: in what time will it be spun, if both work together *Ans.* 6$\frac{6}{7}$ days.

15. Suppose A. can do a piece of work in 18 days, B. the same in 20 days, and C. in 24 days: in what time will they perform it, all working together? *Ans.* 6$\frac{42}{53}$ days.

16. A person having $\frac{3}{5}$ of a vessel, sells $\frac{2}{3}$ of his share for £312: what is the whole vessel worth? *Ans.* £780.

17. What is the weight of 15$\frac{3}{5}$ hhds. tobacco, each weighing 18$\frac{5}{8}$ cwt.? *Ans.* 286 cwt. 3 qrs. 8$\frac{2}{5}$ lb.

18. What will $18\frac{5}{8}$ yards cloth cost, at the rate of $3\frac{1}{2}$ yards for £1$\frac{1}{3}$? *Ans.* £9 11s. $6\frac{2}{4}$d. $\frac{3}{7}$

19. Sold sugar at $10\frac{3}{4}$d. per lb., and gained $7\frac{1}{2}$ per cent.: what was it bought at per cwt.? *Ans.* £4 13s. 4d.

20. Suppose M. has $\frac{2}{3}$ of a ship, and sells to N. $\frac{3}{4}$ of his share, and that N. sells O. $\frac{1}{2}$ of his part: what share of the ship has O. and what part has M. and N. separately left? *Ans.* O. has $\frac{1}{4}$, M. $\frac{1}{6}$, and N. $\frac{1}{4}$.

21. Reduce $\frac{3}{4}$ of $\frac{4}{9}$ of $\frac{1}{3}$ of $\frac{3}{10}$ of $\frac{5}{12}$ to a simple fraction? *Ans.* $\frac{1}{72}$.

22. What is the difference between 100· and ·001 ? *Ans.* 99·999.

23. What number is that from which if you take $\frac{2}{7}$ of $\frac{3}{8}$, and to the remainder add $\frac{7}{18}$ of $\frac{1}{20}$ the sum will be 10 ? *Ans.* $10\frac{191}{2240}$.

24. A. can do a piece of work in $6\frac{1}{2}$ days, B. can do the same in $4\frac{1}{4}$ days, and C. in $3\frac{1}{3}$ days: if you set them all at work together, in what time will they finish it? *Ans.* $1\frac{687}{1523}$ days.

25. The diameter of the earth is 7912 miles, and the circumference is $3\frac{1}{7}$ times the diameter: if a man of 6 feet in height were to travel round the earth, how many yards would his head go farther than his feet? *Ans.* $12\frac{4}{7}$ yards.

26. If a wall $57\frac{3}{4}$ yards long, $12\frac{7}{12}$ feet high, and $1\frac{1}{2}$ brick thick, cost £342 15s. building: what will a wall $34\frac{5}{8}$ yards long, $11\frac{1}{4}$ feet high, and $2\frac{1}{2}$ bricks thick cost? *Ans.* £308 4s. $\frac{637}{2567}$.

27. Goliah, the Philistine, is said to have been $6\frac{1}{2}$ cubits high, each cubit 1 foot 7·168 inches English: what was his height in English feet? *Ans.* 10·3826 feet.

28. What number is that from which if you take $13\frac{1}{2}$ the remainder will be $5\frac{3}{7}$? *Ans.* $19\frac{3}{14}$.

29. If the value of $\frac{3}{7}$ of a ship be £921$\frac{1}{4}$: what will $\frac{5}{9}$ come to? *Ans.* £1194 4s. $3\frac{1}{9}$d.

30. If $\frac{2}{3}$ of $\frac{7}{18}$ of an estate be worth £107 10s.: required the value of the whole? *Ans.* £414 12s. $10\frac{1}{4}$d. $\frac{1}{7}$

31. A gentleman left an estate to his three sons; the eldest got $\frac{2}{3}$ of $\frac{7}{8}$ of it, the second got $\frac{3}{4}$ of $\frac{2}{5}$, and the third £1007$\frac{9}{10}$: what was the value of the whole estate, and how much did the first and second sons receive? *Ans.* £8639 2s. $10\frac{1}{4}$d. $\frac{1}{7}$ value of estate; 1st son got £5039 10s.; the 2nd, £2591 14s. $10\frac{1}{4}$d. $\frac{1}{7}$

32. Suppose A. has $\frac{1}{2}$ of a ship, and sells to B. $\frac{3}{4}$ of his share, and B. sells $\frac{1}{2}$ of his share to C.: required C.'s share, and what part A. and B. had left?

$\quad\quad\quad\quad\quad$ Ans. C.'s share $\frac{3}{16}$; A. has $\frac{1}{8}$ and B. $\frac{3}{16}$ left.

33. A bankrupt's effects amount to $\frac{3}{5}$ of his debts: what is that per pound? $\quad\quad\quad\quad\quad\quad\quad$ Ans. 12s. per £.

34. Divide £78$\frac{2}{5}$ among four men and two women, and give each of the women $\frac{3}{4}$ of a man's share.

$\quad\quad\quad$ Ans. A man's share £16 16s., a woman's £5 12s.

35. If 248 men, in 5$\frac{1}{2}$ days of 11 hours each, dig a trench of 7 degrees of hardness, 232$\frac{1}{2}$ yards long, 3$\frac{2}{3}$ wide, and 2$\frac{1}{3}$ deep: in how many days, of 9 hours long, will 24 men dig a trench of 4 degrees of hardness, 337$\frac{1}{2}$ yards long, 5$\frac{3}{4}$ wide, and 3$\frac{1}{2}$ deep? $\quad\quad\quad\quad\quad\quad\quad\quad$ Ans. 132 days.

36. A person left $\frac{2}{5}$ of his property to A., $\frac{3}{10}$ to B., $\frac{1}{8}$ to C., $\frac{1}{20}$ to D., $\frac{1}{40}$ to E., $\frac{1}{50}$ to F., and the rest, which was £300, to his executor: what was the value of the whole property, and of each person's share?

$\quad\quad$ Ans. Value of property £10,000; A.'s share £4000, B.'s
$\quad\quad\quad\quad$ £3000, C.'s £1250, D.'s £500, E.'s £250, F.'s £200.

37. Bought 18$\frac{5}{8}$ cwt. sugar, at £4$\frac{1}{2}$ per cwt., and sold it at 11$\frac{1}{4}$d. per lb.: what was gained or lost on it?

$\quad\quad\quad\quad\quad\quad\quad\quad\quad$ Ans. £19 11s. 1$\frac{1}{2}$d. gained.

38. What number is that from which if you take $\frac{3}{5}$, the remainder will be $\frac{1}{9}$? $\quad\quad\quad\quad\quad\quad\quad$ Ans. $\frac{2.9}{4.5}$.

39. What is the interest of £456$\frac{7}{8}$, for 4$\frac{5}{6}$ years, at 4$\frac{1}{4}$ per cent.? $\quad\quad\quad\quad\quad\quad\quad$ Ans. £89 16s. 1d. $\frac{3}{4}$

40. Four men, A.B.C.D., got a present of a guinea, of which A. claims $\frac{1}{2}$, B. $\frac{1}{3}$, C. $\frac{1}{4}$, D. $\frac{1}{5}$, but they find it too little: it is required, therefore, their shares of it in the above proportion.

$\quad\quad$ Ans. A.'s share 8s. 2d. $\frac{2}{11}$, B.'s 5s. 5d. $\frac{5}{11}$, C.'s 4s. 1d. $\frac{1}{11}$,
$\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad$ D.'s 3s. 3d. $\frac{3}{11}$

41. B. can perform a piece of work in 9 hours, C. in 8$\frac{1}{2}$, and D. in 6$\frac{3}{4}$ hours: in what time will they perform it all working together? $\quad\quad\quad\quad\quad\quad$ Ans. 2$\frac{113}{173}$ hours.

42. There is a mast or pole, $\frac{1}{9}$ of its length stands in the ground, 12 feet of it in the water, and $\frac{5}{8}$ of its length in the air or above water: what is its whole length? $\quad$ Ans. 216 feet.

43. A young man received £210, which was $\frac{3}{4}$ of his elder brother's portion; now 3 times the elder brother's portion was $\frac{1}{2}$ of the father's estate: required the value of his estate.

$\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad$ Ans. £1890.

44. What fraction is that to which if you add $\frac{2}{3}$ the sum will be $\frac{5}{6}$? $\quad\quad\quad\quad\quad\quad\quad\quad$ Ans. $\frac{1.3}{3.0}$.

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45. Suppose 264 men, in $5\frac{3}{4}$ days of $10\frac{1}{2}$ hours long, can build a wall $234\frac{2}{3}$ yards long, $3\frac{3}{4}$ broad, and $5\frac{3}{4}$ high: in how many days of $9\frac{3}{4}$ hours long, will 25 men build another wall $337\frac{1}{2}$ yards long, $4\frac{1}{2}$ broad, and $7\frac{1}{2}$ high?   *Ans.* $141\frac{3}{4}$ days.

46. A ship worth £8000, of which £4800 are insured, is totally lost, of which $\frac{1}{2}$ belongs to B., $\frac{1}{3}$ to C., $\frac{1}{10}$ to D., and the rest to E.: what part of the insurance will each partner receive?
                    Ans. B. £2400, C. £600, D. £480, E. £1320.

47. A sum put out to interest $4\frac{1}{2}$ years ago, at $4\frac{1}{2}$ per cent., amounts to £$756\frac{5}{18}$: what was the principal?
                              Ans. £628 19s.

48. The rent of $\frac{12}{14}$ of a meadow was £3 12s.: what will be the rent of $\frac{8}{9}$ of $\frac{7}{13}$ at that rate?   *Ans.* £1 17s. $1\frac{1}{4}$d. $\frac{67}{88}$

49. If $27\frac{1}{2}$ yards of cloth, $\frac{13}{12}$ yard wide, cost £10 13s. 4d.: what will $7\frac{3}{4}$ yards cost when only $\frac{11}{12}$ yard wide?
                              Ans. £2 10s. $10\frac{1}{4}$d. $\frac{11}{13}$

50. B. C. and D. working together, can finish a piece of work in 8 days, which B. can do by himself in 24 days, and C. in 22: in what time could D. do it?   *Ans.* $26\frac{2}{5}$ days.

51. Three men, E. F. and G., entered into company; E. continued his share of the stock for 4 months, and claimed $\frac{1}{5}$ of the profits, F. continued his for 9 months, G. continued his stock of £550, for 8 months, and received $\frac{1}{2}$ of the gain: required E. and F.'s stock.   *Ans.* E.'s £440, F.'s £293$\frac{1}{3}$.

52. Suppose a wolf could devour a sheep in an hour, a tiger in $\frac{1}{4}$ hour, and a lion in $\frac{1}{2}$ hour; and that the wolf eats 10 minutes by himself, after which the tiger arrives and eats along with him 10 minutes longer, then the lion arrives, and all three eat together: required the time in which the sheep will be devoured.   *Ans.* $21\frac{3}{4}$ minutes in all.

53. Two Arabians sat down to dinner; one had 5 loaves, and the other 3: a stranger passing by desired permission to eat with them, to which they agreed. The party having finished their loaves, the stranger laid down 8 pieces of money and departed. The proprietor of the 5 loaves took up 5 pieces, and left 3 for the other, who objected, and insisted on half. Upon this the affair was referred to a magistrate, who gave the following judgment. Let the owner of the 5 loaves have 7 pieces, and the owner of the 3 loaves 1. Was this decision just?
                              Ans. It was just.

QUESTIONS FOR EXAMINATION IN VULGAR AND DECIMAL FRACTIONS.

What do you mean by a fraction? What is the number below the line called? Why? What is the number above the

line called? Why? What are meant by the terms of a frac-
tion? How many kinds of vulgar fractions are there? What
is a simple fraction? How many kinds of simple fractions are
there? What is a proper fraction? What is an improper frac-
tion? Of what does a compound fraction consist? What is a
complex fraction? How do you reduce fractions to less terms?
How do you reduce fractions to their least terms? How do
you reduce an improper fraction to a whole or mixed number?
How do you reduce a mixed fraction to an improper fraction?
How do you reduce a whole number to a fraction of a given
denominator? How do you reduce a compound fraction to a
simple fraction? How do you reduce fractions of different
denominators to others of equal value that have a common one?
How do you reduce a complex fraction to a simple one? How
do you reduce fractions from one denominator to another? How
do you reduce money, weights and measures, to a fraction of a
given name? How do you find the value of a fraction? Of
two given fractions, how do you find which has the greater
value? How do you proceed in addition of vulgar fractions?

How is the operation in subtraction performed? How do you
perform multiplication of vulgar fractions? How do you pro-
ceed in division of vulgar fractions? What is a decimal frac-
tion? In decimal fractions is a denominator used? How then
are decimals distinguished from whole numbers? What is a
mixed number in decimals? Do ciphers on the right hand of
decimals alter their value? What effect have ciphers on the
left hand with the decimal point prefixed? What do you mean
by a terminate or finite decimal? What are interminate deci-
mals? How do you add decimal fractions? subtract? mul-
tiply? divide? How do you reduce a vulgar fraction to a
decimal fraction? How do you reduce a decimal fraction to a
vulgar fraction? How do you reduce numbers of a lower name
to the decimal of a higher? How do you find the value of a
decimal of a given integer? Is there not an easy rule, for prac-
tical use, by which you can, mentally, reduce shillings, pence
and farthings, to the decimal of a £? Repeat it. Repeat the
converse rule for mentally finding the value of the decimal of a
£? What is a repeating or circulating decimal? What is a
single repeater? What is a compound repeater or circulate?
What is a mixed repeater? How do you reduce a single or
compound repeater to a vulgar fraction? How do you reduce
a mixed repeater to a vulgar fraction? How do you add single
repeating decimals? How do you add compound repeaters or
circulates? How do you subtract single repeaters? How do
you subtract compound repeaters or circulates? How do you

multiply when the multiplicand has a single repeater? When
it has a circulate? How do you multiply when the multiplier
is a repeater or circulate? How do you divide when the divi-
dend has a repeater or circulate? How do you divide when the
divisor is a repeater or circulate?

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PART V.

EXCHANGE.

Exchange is the method of finding how much of the money
of one nation is equal in value to any proposed sum of the
money of another country.

The *Par of Exchange* is the intrinsic value of the money of
one nation, compared with that of another nation, which is
estimated by the quantity of pure gold or silver.

The *Course of Exchange* is the current value allowed for
the money of one country when reduced to the money of any
other country. This is seldom at par, but is continually vary-
ing according to the circumstances of trade.

Agio is the difference between bank and current money, and
also between the intrinsic and circulating value of foreign coins.

Usance is the usual time allowed by merchants and bankers
to pay bills of exchange.

Days of Grace are the days allowed for paying bills after
their term is expired.

Note. All calculations in Exchange may be performed by Pro-
portion and often by Practice.

HOLLAND.

Accounts are kept in florins or guilders, stivers and pennings.

There are two kinds of money in Holland, viz., *banco* and
currency. Banco is more valuable than currency ; the diffe-
rence is called *agio,* and varies from 2 to 5 per cent.

Exchange with Britain varies from 34s. to 37s. gross or
Flemish per £ sterling. Usance 30 days after date, and 6 days
of grace.

> 16 pennings, or 2d. Flem. = 1 stiver.
> 6 stivers,   or 12d. Fl. = 1 shilling Flemish.
> 20 stivers,   or 3s. 4d. Fl. = 1 guilder or florin.
> 2½ guilders, or 8s. 4d. Fl. = 1 rixdollar.
> 6 guilders, or 20s. Fl.   = 1 pound Flemish.

To reduce banco into currency, and the contrary, say,

As 100 : 100 + agio : : banco : currency.
As 100 + agio : 100 : : currency : banco.

1. How many guilders current in 48,750 guilders banco, agio 4¾?   *Ans.* 51,065⅝ guilders.

2. How many guilders banco in 7864 guilders current, agio 2¼?   *Ans.* 7690 $\frac{390}{409}$ gui. banco.

3. How much sterling in 7846 guilders banco, exchange 34s. 6d. Flem. per £ sterling?   *Ans.* £758 1s. 4d. $\frac{16}{69}$ ster.

4. How many guilders in £4850 sterling, exchange 36s. 6d.?
                     Ans. 53,107½ guilders.

5. In £100 sterling, how many stivers, exchange 36s. 6d. Flem. per £ sterling?   *Ans.* 21,900 stivers.

6. Britain draws on Amsterdam for £464 15s. sterling : how many pounds Flemish will pay the draft, exchange 35s. 4d. Flemish per £ sterling?   *Ans.* £821 1s. 2d. Flem.

7. In £7968 10s. Flemish : how much sterling, exchange 34s. 8d.?   *Ans.* £4597 4s. 2¾d. $\frac{1}{13}$ ster.

8. Britain remits Amsterdam 4896 guilders, 15 stivers : how much sterling will pay the bill, exchange 35s. 4d.?
                     Ans. £461 19s. 1¾d. $\frac{13}{44}$ ster.

GERMANY.

Hamburgh, like Holland, has two kinds of money, banco and current, the agio between which varies from 20 to 25 per cent. Bills of exchange are valued and paid in banco ; and exchanges are transacted by the pound Flemish. Accounts are generally kept in marks and schillings. Usance 30 days after date, and 12 days of grace.

6 phennings,		= 1 penny Flemish.
12 phennings,	or 2d. Fl.	= 1 schilling.
6 schillings,	or 12d. Fl.	= 1 schilling Flem.
16 schillings,	or 2s. 8d. Fl.	= 1 mark.
2 marks,	or 5s. 4d. Fl.	= 1 dollar of exchange.
3 marks,	or 8s. Fl.	= 1 rixdollar.
7½ marks,	or 20s. Fl.	= 1 pound Flemish.

1. How many dollars banco in 865 dollars currency, agio 20 per cent.?   *Ans.* $720⅝ banco.

2. How much sterling in 8347 marks banco, exchange 32s. 2d. per £ sterling?   *Ans.* £691 19s. 7d. $\frac{5}{193}$

3. How many marks banco in £9648 sterling, exchange 33s. 10d.?   *Ans.* 122,409 marks.

4. How much sterling money in 4173 marks 8 schillings banco, exchange 32s. 2d. Flem. banco per £ sterling?
                     Ans. £345 19s. 9½d. $\frac{10}{193}$

5. In 24,680 phennings : how many rixdollars?
Ans. 42 rixd. 2m. 8s. 8p.

6. In £684 sterling : how many florins ?   (1½ florin is equal to ¶ rixdollar, and a rixdollar is equal to 59·485 pence sterling.)
Ans. 4139.531 florins.

FRANCE.

In France, accounts are kept in francs and centimes ; and sometimes in livres, sous, and deniers.

Exchange with Britain about 24 francs per £ sterling, or 29½d. per French crown. Usance 30 days after date, and 10 days of grace. Par with Britain is 23 francs 23 cents per £ sterling.

Old coinage.

12 deniers	= 1 sou.
20 sous	= 1 livre.
3 livres	= 1 ecu or crown.
25 livres or 8 crowns	= 1 louis.

New coinage.

10 centimes	= 1 decime.
10 decimes or 100 centimes	= 1 franc.
24 francs	= 1 Napoleon or Louis.
80 francs	= 81 livres.

1. How much sterling in 480 livres, exchange 30½d. sterling per French crown ?   *Ans.* £20 6s. 8d.

2. How much French money in £2399 7s. 4d. sterling, exchange 24 francs 75 cents. per £ sterling ?
Ans. 59384 francs 32½ cents.

3. In £500 sterling : how many livres, exchange 24 francs per £ sterling?   *Ans.* 12150 livres.

4. How many livres in £893 8s. sterling, exchange 24 livres 25 cents per £ sterling?   *Ans.* 21664 liv. 95 cents.

5. In £1000 sterling : how many francs, exchange at par ?
Ans. 23230 francs.

6. How many livres in 4873 francs 56 cents?
Ans. 4934 livres 47$\frac{19}{20}$ cents.

SPAIN.

In Spain, accounts are kept in reals and maravedis. Money is distinguished into vellon, or copper money, and old plate, i. e. old silver ; in the last of which exchanges are transacted by the dollar of exchange. Vellon bears to old plate a constant ratio of 17 to 32 : thus, 32 reals vellon=17 reals plate. Usance 60 days after date, and 14 days of grace.

34 maravedis vellon	= 1 real vellon.
34 maravedis O. P. or 64 mar. vel.	= 1 real O. P.
8 reals O. P. or 15 reals 2 mar. vel.	= 1 peso, or dol. of ex.
32 reals O. P.	= 1 pistole of ex.
375 mar. O. P. 11 reals 1 mar. O. P.	= 1 ducat of ex.

Note. In drawing bills of exchange on Spain, it is usual to insert the words *payable in effective,* that they may not be paid in exchequer bills, which are at a considerable discount.

1. How much sterling in 930 reals vellon, exchange $37\frac{1}{2}$d. per dollar?   *Ans.* £9 12s. $11\frac{1}{4}$d. $\frac{43}{64}$

2. In £1175 13s. 4d. sterling : how many reals old plate, exchange 39d.?   *Ans.* 57878 r. $33\frac{5}{39}$ mar.

3. In £867 8s. 6d. sterling : how many reals vellon, exchange $36\frac{1}{4}$d. per peso ?   *Ans.* 86482 re. $3\frac{44}{145}$ mar.

4. How much sterling in 1500 reals plate, exchange 42d.?
    Ans. £32 16s. 3d.

5. How many pounds sterling are there in 794 pistoles, exchange 42d. per peso?   *Ans.* £555 16s.

PORTUGAL.

In Portugal, accounts are kept in milrees and rees.

Exchange with Britain, 60d. to 70d. per milree; par $67\frac{1}{2}$d. Usance 30 days after sight, and 6 days of grace.

| 1000 rees = 1 milree. | 4800 rees = 1 moidore. |
| 400 rees = 1 crusado. | 6400 rees = 1 joannes. |

1. Reduce 2496 milrees, 120 rees, into sterling money ; exchange 64d. per milree.   *Ans.* £665 12s. $7\frac{1}{2}$d. $\frac{19}{25}$ ster.

2. In £421 17s. 6d. sterling : how many milrees, exchange $67\frac{1}{2}$d.?   *Ans.* 1500 milrees.

3. In 912 milrees, 300 rees : how much sterling, exchange 50d. per milree?   *Ans.* £190 1s. 3d.

4. In £2078 15s. $9\frac{3}{4}$d. sterling: how much Portuguese money, exchange $62\frac{3}{4}$d. per milree?   *Ans.* 7998 m. $553\frac{53}{499}$.

5. What is the intrinsic value of a joannes, exchange at par, or 5s. $7\frac{1}{2}$d.?   *Ans.* 36s. ster.

6. What is the intrinsic value of a moidore, exchange at par, or 5s. $7\frac{1}{2}$d.?   *Ans.* 27s. ster.

ITALY.

Money is here distinguished into lire and pezza or exchange money, or into *moneta buona* and *moneta lunga,* the former is more valuable than the latter in the ratio of 24 to 23. Accounts are kept in the latter, and exchange transacted by the former. Par 49.455 pence.

12 denari = 1 soldo. | 20 soldi = 1 lira.

Venice exchanges by the ducat banco of 6½ lire.
Genoa exchanges by the pezza of 5¾ lire.
Leghorn exchanges by the piastre of 6 lire.
Florence exchanges by the ducat of 7½ lire.

The ducat, pezza, piastre, &c., are each divided into 20 soldi, and those into 12 denari, in the same manner as the lira money. Usance 3 months after date, and no days of grace.

At Rome, accounts are kept in scudi or crowns, jiulis or paoli. Exchange with Britain by the scudo, for a variable number of pence ; par 84.59 pence. Usance 2 days after acceptance, and no days of grace.

At Naples, accounts are kept in ducats, carlins, and grains. Exchange with Britain by the ducato di regno, for a variable number of pence; par 44 pence. Usance 3 months after date, and 3 days grace.

10 grani = 1 carlino.
10 carlini = 1 ducato.
12 carlini = 1 scudo.

1 How much sterling in 7860 ducats banco of Venice, exchange 52d.?   *Ans.* £1703 ster.

2. How many ducats in £2014 10s., exchange 51d. per ducat?   *Ans.* 9480 ducats.

3. In 47868 pezze of Genoa : how much sterling, exchange 51¾d.?   *Ans.* £10,321 10s. 9d. ster.

4. In 10,321 10s. 9d. sterling : how many pezze, exchange 51¾d.?   *Ans.* 47,868 pezze.

5. How many lire of Leghorn in £665 2s. 6d. : exchange 51d.?   *Ans.* 18,780 lires.

6. How many lire of Florence in £132 10s. 6d. : exchange 62d.?   *Ans.* 3847 lires 10 soldi.

7. How much sterling in 1102 ducats of Naples, exchange 3s. 4d.?   *Ans.* £183 13s. 4d. ster.

8. Reduce £548 14s. 6d. sterling into ducats ; exchange 4s. per ducat.   *Ans.* 2743⅝ ducats.

DENMARK AND NORWAY.

In Denmark and Norway accounts are kept in rix-dollars, marcs and skillings. Exchange with Britain from 4 to 5 rix-dollars per £; par 4s. 9.67. Usance 60 days after sight, and 10 days of grace.

16 skillings = 1 marc. | 4 marcs = 1 ort.
 6 marcs   = 1 rix-dollar. | 11 marcs = 1 ducat.

1. In £6780 sterling : how many rix-dollars, exchange 4½ ?
$\qquad$ *Ans.* 30,510 rix-dollars.

2. In 8964 rix-dollars 2 marcs 8 skillings : how much sterling, exchange 4⅗ ? $\qquad$ *Ans.* £1854 14s. 1½d. $\frac{18}{29}$

3. Reduce £480 sterling into rix-dollars currency, exchange 3s. 6d. per rix-dollar: $\qquad$ *Ans.* 2742⁶⁄₇ rix-dollars.

4. How much sterling money in 1000 marcs ; exchange at 4s. 2d. per rix-dollar ? $\qquad$ *Ans.* £34 14s. 5¼d. ⅓

PRUSSIA.

In Prussia and Poland accounts are kept in Polish rix-dollars and groschen.

$$12 \text{ pfenings} = 1 \text{ grosche.}$$
$$24 \text{ groschen} = 1 \text{ rix-dollar.}$$
$$30 \text{ groschen} = 1 \text{ florin.}$$
$$\text{In Dantzick } 18 \text{ pfenings} = 1 \text{ grosche.}$$

Exchange with Britain at so many rix-dollars per £ ster.

1. How much Prussian money in £576 sterling ; exchange 6¼ rix-dollars ? $\qquad$ *Ans.* 3600 rix-dollars.

2. In 2925 rix-dollars Prussian : how much sterling money, exchange 6½ rix-dollars ? $\qquad$ *Ans.* £450 ster.

RUSSIA.

In Russia accounts are kept in rubles and copecs. Exchange with Britain by the ruble. Usance 3 months after date, and 10 days of grace.

$$100 \text{ copecs} = 1 \text{ ruble.}$$

1. What is the value of 1636 rubles drawn on London, exchange 4s. 5½d. ? $\qquad$ *Ans.* £364 13s. 10d.

2. Reduce £763 sterling into rubles ; exchange 3s. 4d. per ruble. $\qquad$ *Ans.* 4578 rubles.

SWEDEN.

In Sweden, exchanges are computed in rix-dollars, skillings and fennings, by giving a variable number of rix-dollars for £1 sterling. The intrinsic value of the rix-dollar is 57.82d. sterling, and the par of exchange 4 rix-dollars 7 skillings per £ sterling.

$$12 \text{ fennings} = 1 \text{ skilling.}$$
$$48 \text{ skillings} = 1 \text{ rix-dollar.}$$

1. Reduce 4963 rix-dollars 12 skillings, Swedish money, to sterling ; exchange at 4 rix-dollars 24 skillings per £ sterling.
$\qquad$ *Ans.* £1102 18s. 10½d. ⅔

2. In £1102 18s. 10½d. ⅔ sterling : how much Swedish money, exchange at 4½ rix-dollars per £ sterling ?
$\qquad$ *Ans.* 4963 rix-dollars 12 skillings.

WEST INDIES.

Accounts are kept in all the English West India Islands in pounds, shillings and pence, currency. The currency fluctuates in value in all the islands except Jamaica, where the ratio of currency to sterling is as 7 to 5; that is, £7 Jamaica currency are equal to £5 sterling; £140 currency are equal to £100 sterling. The Spanish dollar is the principal coin circulating in the West Indies, and it seems to be the standard by which the value of all other monies is regulated. When the currency is as £140 to £100 sterling, it passes for 6s. 8d.; and other coins in proportion. In Jamaica, bills on London have been sometimes at a premium of 20 per cent. above the legal exchange, and they are seldom under 10. Dollars occasionally bear a premium of 3 or 4 per cent.

1. In £960 10s. Jamaica currency: how much sterling, exchange £140 per £100 sterling?   *Ans.* £686 1s. 5¼d.

2. Reduce £686 1s. 5¼d. sterling to Jamaica currency; exchange £140 currency per £100 sterling.
                              Ans. £960 10s. currency.

3. Reduce £778 16s. 4d. currency to sterling; exchange at £166 currency per £100 sterling.   *Ans.* £469 3s. 4d.

4. Reduce £469 3s. 4d. sterling to currency; exchange at £166 currency per £100 sterling.   *Ans.* £778 16s. 4d.

UNITED STATES OF AMERICA.

In the United States, accounts are kept in dollars, dimes and cents; and in some parts in pounds, shillings and pence, currency.

Exchanges are computed in dollars and cents; the par being 4 dollars 44 cents per £ sterling, or 4s. 6d. per dollar.

The exchange with London is either at par, or at so much per cent. above or below par, according to the balance of trade. The gold coins of the United States are eagles, half eagles and quarter eagles; the eagle being of the value of 10 dollars. The silver coins are dollars, half dollars, quarter dollars, dimes or tenths of dollars, and half dimes; a cent is the only copper coin.

        10 cents   = 1 dime.
        10 dimes, or 100 cents = 1 dollar (4s. 6d. ster.)
        10 dollars   = 1 eagle.

The current value of the dollar varies considerably in different States. In the New England States, Virginia, Kentucky, and Tennessee, the dollar is worth 6s. currency; or £4 currency equal to £3 sterling.

In Pennsylvania, New Jersey, Delaware and Maryland, the dollar is worth 7s. 6d. currency; or £5 currency equal to £3 sterling.

In New York and North Carolina, the dollar is worth 8s. currency; or £16 currency equal to £9 sterling. In South Carolina and Georgia the dollar is worth 4s. 8d. currency; or £28 currency equal to £27 sterling.

1. Reduce 891 dollars 90 cents to sterling money; the exchange being at par, or 4s. 6d. sterling per dollar.
                                         Ans. £200 13s. 6½d. ⅔

2. Reduce £200 13s. 6½d. ⅔ sterling, to American States money, at par.   *Ans.* 891 dollars 90 cents.

3. Reduce 2141 dollars 25 cents to sterling; exchange at 2 per cent. above par, or at a premium of 2 per cent.

As 100 : 102 : : 54d. : 55.08 pence.

As 100 cents : 55.08 : : 214125 cents : £491 8s. 4d. $\frac{1}{25}$ ans.

4. Reduce £491 8s. 4d. $\frac{1}{25}$ sterling to United States money, at 2 per cent. above par.

As above—55.08 pence : 100 cents : : 117940.05 pence :
                                         2141 dollars 25 cents. ans.

5. Reduce 1823 dollars 25 cents to sterling; exchange at 2 per cent. under par, or at a discount of 2 per cent.

102 : 100 : : 54 : $\frac{5400}{102}$

$\frac{1}{100} \times \frac{5400}{102} \times \frac{182325}{1} = £402$ 3s. 9d. ans.

6. Reduce £402 3s. 9d. sterling, to American United States money; exchange at 2 per cent. under par.
                                         Ans. 1823 dollars 25 cents.

7. How much sterling in £1200 10s. Virginian currency; exchange at £133 6s. 8d. currency per £100 sterling?
                                         Ans. £900 7s. 6d.

8. Reduce £900 7s. 6d. sterling to Virginian currency; exchange at £133⅓ currency per £100 sterling.
                                         Ans. £1200 10s.

Note. See Appendix No. 3.

BRITISH NORTH AMERICA.

In the British possessions of North America, accounts are kept in pounds, shillings and pence, Halifax currency.

The ratio of currency to sterling is $\frac{9}{10}$; that is, £90 sterling are equal to £100 currency. Bills on London generally sell at a premium.

1. In £800 Halifax currency: how much sterling, exchange at par?   *Ans.* £720 sterling.

2. Reduce £720 sterling to Halifax currency; exchange at par.   *Ans.* £800 Halifax currency.

3. Reduce £500 Canadian currency to sterling; exchange at 2 per cent. above par, or at a premium of 2 per cent.

$100 : 102 :: \frac{9}{10} : \frac{918}{1000}$ then £1 cur. : $£\frac{918}{1000}$ ster. :: £500 cur. : £459 ster. ans.

4. Reduce £459 sterling to Canadian currency; exchange at 2 per cent. above par.

$£\frac{918}{1000}$ ster. : £1 cur. :: £459 ster. : £500 cur. ans.

5. How much sterling in £1000 Canadian cur.; exchange at 1 per cent. below par, or 1 per cent. discount?

           Ans. $£891\frac{9}{101}$ ster.

6. Reduce $£891\frac{9}{101}$ sterling to Canadian currency; exchange at 1 per cent. below par.   *Ans.* £1000 Canadian cur.

EAST INDIES AND CANTON.

The principal money of account in India is the *current rupee*, to which real coins are reduced before they are entered into books of accounts. This reduction is performed by adding to the specie a certain per centage called the *batta*, which varies according to the value of the coins, and also according to the rate of exchange.

The *current rupee* is considered as the standard by which all real rupees must be regulated and valued: for, being an imaginary money, it cannot be altered or counterfeited.

At *Calcutta* accounts are kept in current rupees, annas and pice.

       12 current pice   =   1 current anna.
       16 current annas   =   1 current rupee.
     100 sicca rupees   = 116 current rupees.

The East India Company, however, keep their accounts in sicca rupees, annas and pice; which bear a batta of 16 per cent. against current rupees, annas and pice; and their public and financial statements, which are submitted to parliament, each sum of sicca rupees is reduced to current rupees by adding to it this batta, and the current rupee is then reckoned at 2s. sterling.

The coins which are struck at the Calcutta mint are sicca rupees, also called silver rupees; and gold mohurs, which are sometimes called gold rupees; 16 of the former are by regulation to pass for one of the latter.

At *Madras* accounts are kept in star pagodas, fanams and cash.

        80 cash   = 1 fanam.
        42 fanams = 1 star pagoda.

Such is the mode of reckoning used by the East India Company and other European merchants, but among the natives the value of the pagoda varies from 44 to 46 fanams.

The gold coins are star or current pagodas ; and the silver coins arcot rupees. Double and single fanams are current here ; and copper pieces of 20 cash called pice. Also pieces of 5 and 10 cash, called doodee ; and single cash pieces. These copper coins are struck in England, bearing the date of 1803, and the value is marked upon each.

In the Company's books, 100 star pagodas are valued at 425 current rupees ; and 10 star pagodas at 16 Spanish dollars.

At *Bombay* accounts are kept in rupees ; each rupee being divided into 4 quarters, and each quarter into 100 reas.

$$100 \text{ reas} \quad = 1 \text{ quarter.}$$
$$4 \text{ quarters} = 1 \text{ rupee.}$$

The coins of Bombay are the mohur, or gold rupee ; the silver rupee and its half ; also the single and double pice, the ordee and doreca, which are copper coins, with a mixture of tin or lead.

In the Company's financial accounts, which are submitted to parliament, the Bombay rupee is reckoned at 2s. 3d. ; and it then bears a batta of 16 per cent. against current rupees. Its intrinsic value is 23 pence sterling.

At *Canton*, and in all *China*, accounts are kept in liangs or tales ; each tale is divided into 10 maces, each mace into 10 candarines, and each candarine into 10 cash.

$$10 \text{ cash} \quad = 1 \text{ candarine.}$$
$$10 \text{ candarines} = 1 \text{ mace.}$$
$$10 \text{ maces} \quad = 1 \text{ tale.}$$
$$3 \text{ tales} \quad = 1 \text{ £ sterling.}$$

There is but one kind of money in China, called cash, which is not coined but cast, and which is only used for small payments ; it is composed of 6 parts copper and 4 parts lead. A tale of fine silver should be worth 1000 cash, but on account of the convenience of the latter for common use, their price is sometimes so much raised that only 750 cash are given for the tale.

In China, gold is not considered as money, but as merchandise ; it is sold in regular ingots of a determined weight, which the English call shoes of gold ; silver ingots are used as money, and are from $\frac{1}{2}$ to 100 tales, their value being determined by their weight. These ingots are of the best sort of silver, that is 94 parts fine in 100 ; and the English reckon the tale of silver at 6s. 8d. sterling.

ALLIGATION.

Alligation is a name given to the rules for ascertaining the prices and proportionate quantities of mixtures, and is divided into *medial* and *alternate*.

ALLIGATION MEDIAL.

Given the quantities and rates of the several simples, to find the rate of the mixture.

RULE. Multiply each quantity by its rate, and divide the sum of the products by the sum of the quantities.

Nine gallons of wine, at 5s. 4d. per gallon, are mixed with 8 gallons at 6s. 8d. per gallon, 8 gallons at 7s. 7d., and with 3 gallons of water: what is the value of the mixture per gallon?

$$
\begin{array}{ll}
 & \quad s. \quad d. \\
9 \text{ gallons at 5s. 4d.} = 48 & 0 \\
8 \text{ gallons at 6s. 8d.} = 53 & 4 \\
8 \text{ gallons at 7s. 7d.} = 60 & 8 \\
3 \text{ gallons water} &
\end{array}
$$

28   )162   0(5s. 9¼d. ⁵⁄₇ ans.

1. A grocer mixed 8lb. sugar, at 7d. per lb. with 5lb. at 8d. per lb. and 7lb. at 1s. per lb.: what is the price of the mixture per lb.?   *Ans.* 9d. per lb.

2. A spirit merchant mixes 19 gallons of cognac brandy at 22s. per gallon, and 17 gallons of wine brandy at 17s. 6d., with 10 gallons of another sort at 18s. 10d.: what is a gallon of the composition worth?   *Ans.* 19s. 7¾d. ₃⁄₂₃

3. A malster mixes 70 bushels of malt at 10s. per bushel, 100 bushels at 9s. 6d., 50 bushels at 9s. 2d., and 37 bushels at 8s. 9d. per bushel: what is the mixture rate of a bushel?
                        Ans. 9s. 5½d. ₆₂⁄₂₅₇

4. 8lbs. of tea at 5s. 7½d. were mixed with 12lbs. at 8s. 3d., and with 16lbs. at 9s.: required the value of a lb. of the mixture.
                        Ans. 8s. per lb.

5. A compounder of spirits mixes 18 gallons at 3s. 6d. with 12 gallons at 5s. 7d. and 16 gallons at 4s. 4d.: at what must he sell the compound that his gain may be 10 per cent.?
                        Ans. 4s. 9⅕d. per gal.

ALLIGATION ALTERNATE.

Given the rates of the mixture and simples, to find the quantity of each simple.

RULE. Write the rates of the simples under each other, with the mixture rate on their left hand. Connect or link the rates of the simples, so that one less than the mixture rate shall be always linked with one that is greater. Write the difference betwixt the mixture rate and that of each of the simples opposite to that rate with which it is linked. These differences, or their sum, if more than one, will be the quantities at the rates opposite to which they stand.

How much sugar, at 4d. 6d. and 9d. per lb., must be mixed together, that the composition may be worth 8d. per lb. ?

ANSWERS.

$$8 \begin{cases} 4 \\ 6 \\ 9 \end{cases} \quad 4+2=6 \qquad \begin{array}{l} 1 \text{ lb. at } 4 = 4 \\ 1 \text{ lb. at } 6 = 6 \\ 6 \text{ lb. at } 9 = 54 \end{array}$$

$$\overline{8} \qquad \qquad)64(8\text{d. proof.}$$
$$64$$

1. How much tea at 6s. and 4s. 6d. per lb. must be mixed together to form a composition worth 5s. 6d. per lb. ?

  Ans. 1 lb. at 6s. and ½ lb. at 4s. 6d. or any quantities
               in the same proportion.

2. How much wine at 4s. 5s. 6s. and 8s. must be mixed together, that the composition may be worth 7s.?

         Ans. 6 gal. at 8s., 1 gal. of the rest.

Note 1. When the composition is limited to a certain quantity, say, As the sum of the quantities, found as above, is to the given quantity, so is each of the quantities found to the required quantity of each.

3. How much brandy, at 4s. 5s. and 6s. per gallon, must be mixed together to form a composition of 24 gallons, worth 5s. 6d.?   *Ans.* 16 at 6s., 4 at the rest.

4. How much snuff, at 4s. 6s. and 9s. per lb., must be mixed together to form a composition of 40lb., worth 7s. per lb.?

         Ans. 20 at 9s., 10 at the rest.

Note 2. When one of the simples is limited. say, As the quantity of that simple, found by the method of linking, is to the limited quantity, so are the other quantities found to the required quantity of each.

5. How much wine, at 4s. 6s. and 7s. per gallon, must be mixed with 6 gallons, at 5s. per gallon, that the mixture may be worth 5s. 6d. per gallon?

        Ans. 6 at 5s. and 6s., 18 at the rest.

6.   How much brandy, at 5s., 5s. 6d. and 6s. per gallon, must be mixed with 3 gallons at 4s. per gallon, that the compound may be worth 5s. 4d. per gallon?

              Ans. 3 at 4s., 6 at 6s., 12 at 5s., and 24 at 5s. 6d.

Remark.   As in these last two questions there are two simples greater than the mixture price, and two less, they may be linked different ways, and consequently give two different sets of answers: thus,

$$64 \begin{cases} 60- \\ 66- \\ 72- \\ 48- \end{cases} \quad \begin{matrix} 8 \\ 16 \\ 4 \\ 2 \end{matrix} \qquad 64 \begin{cases} 60 \\ 66 \\ 72 \\ 48 \end{cases} \quad \begin{matrix} 2 \\ 4 \\ 16 \\ 8 \end{matrix}$$

the different sets of answers arising from these different results are, however, equally correct or true answers.   The answers already given arise from the first method of linking—those arising from the second, are—3 at 4s. 6 at 6s. ¾ at 5s. and 1½ at 5s. 6d.

INVOLUTION.

Involution is the method of finding the powers of numbers. The number to be involved is itself the first power; or it is called the root of that power it is required to be raised to.   If it be multiplied once into itself, the product is its square or second power.   If twice into itself, the product is its cube or third power, &c.

       Second and third powers of the nine digits.

1st power, or root,	1	2	3	4	5	6	7	8	9
2nd power, or square,	1	4	9	16	25	36	49	64	81
3rd power, or cube,	1	8	27	64	125	216	343	512	729

1.   Raise 23 to the biquadratic, or 4th power.

                      Ans. 279841.

2.   Raise 31 to the sursolid, or 5th power.   *Ans.* 28629151.

3.   The lineal side of a square table was 38 inches: how many square inches did it contain?   *Ans.* 1444.

4.   The lineal side of a cubic block of marble measures 5 feet: how many solid feet does it contain?   *Ans.* 125.

5.   How many ⅗ inch cubes can I get out of a 9 inch cube?

                      Ans. 3375.

EVOLUTION.

Evolution is the method of finding the roots of numbers.

The *square root* is that of which the given number is the square.

The *cube root* is that of which the given number is the cube.

TO EXTRACT THE SQUARE ROOT.

RULE. Divide the number into periods of 2 figures, beginning at the place of units.

Find the greatest square contained in the left hand period, and place its root in the quotient, and subtract the square itself from that period, and to the remainder annex the second period for a dividend.

Double the figure in the quotient or root for a divisor; by which divide the dividend, omitting the right hand figure, and place the result both in the root and on the right of the divisor; also, by it multiply the divisor thus completed, and subtract the product from the dividend, and to the remainder annex the next period for a new dividend.

To the completed divisor add the figure last put in the root, the sum is a new divisor, with which proceed as before.

Required the square root of 1903140625 ?

```
        19,03,14,06,25(43625  root.
        16                                    43625
        ──                                    43625
     83) 303                                  ─────
      3  249                                  218125
                                               87250
     ───  ───                                 ──────
     866) 5414                                261750
       6  5196                               130875
                                            174500
    ───   ────                              ──────────
    8722) 21806
       2  17444                             1903140625  proof.

    ───── ──────
    87245) 436225
           436225
```

Note 1. If there be a remainder after all the periods are used, the operation may be continued to decimals by annexing periods of ciphers.

2. Any figure of the root is an integer, or a decimal, according as the period from which it arises is an integer or decimal.

3. The square root of a fraction is got by taking the roots of its two terms, if it can be done exactly; if not, reduce the fraction to a decimal, and extract the root as before.

What is the square root of

1.	23409 ?	*Ans.* 153.
2.	6031936?	*Ans.* 2456.

What is the square root of

3.	3437316?	*Ans.* 1854.
4.	1194877489 ?	*Ans.* 34567.
5.	7334552164?	*Ans.* 85642.
6.	8742·25?	*Ans.* 93·5.
7.	123369·5376 ?	*Ans.* 351·24.
8.	7590·417129 ?	*Ans.* 87·123.
9.	1010025 ?	*Ans.* 1005.
10.	·001225 ?	*Ans.* ·035.
11.	·000225 ?	*Ans.* ·015.
12.	·00000784 ?	*Ans.* ·0028.
13.	81325225·8025 ?	*Ans.* 9018·05.
14.	2· ?	*Ans.* 1·41421356+.
15.	7· ?	*Ans.* 2·64575131+.
16.	1000 ?	*Ans.* 31.6227766+.
17.	$\frac{25}{36}$?	*Ans.* $\frac{5}{6}$.
18.	$\frac{243}{1728}$?	*Ans.* $\frac{3}{8}$.
19.	$25\frac{9}{16}$?	*Ans.* $5\frac{3}{4}$.
20.	$9\frac{31}{49}$?	*Ans.* $3\frac{6}{7}$.
21.	$\frac{3}{4}$?	*Ans.* ·866025403+.
22.	$2\frac{1}{3}$?	*Ans.* 1·52752523+.
23.	68·3 ?	*Ans.* 8·26639784+.
24.	·000000005329 ?	*Ans.* .000073.

USES OF THE SQUARE ROOT.

I. To find a *mean proportional* between two given numbers, extract the square root of their product.

1. Find the mean proportional between 3 and 12. *Ans.* 6.
2. Find the mean proportional between 4 and 36. *Ans.* 12.
3. Find the mean proportional between 7 and 135.

<div align="right">Ans. 30·74+.</div>

II. To find the side of a square equal in area to any given surface, extract the square root of the given area.

4. Required the side of a square equal in surface to an irregular bounded field containing 40 acres ?   *Ans.* 80 poles.

5. A gentleman has a field of an irregular form, containing 10 acres, which he wants to exchange for a square field of the same extent : required the side of the square in poles.

<div align="right">Ans. 40 poles.</div>

6. A gentleman has a fish pond, in form of a triangle, containing 480 poles ; he wants another of equal area, in form of a square : required its side.   *Ans.* 21·9089+poles.

7. A plantation of an irregular form, containing 6400 poles, another of a square form is wanted 3 times as large : required the length of its side. *Ans.* 138·564+poles.

8. A farmer has 2 fields ; the 1st contains 7 acres 2 roods 8 poles,—the 2nd, 5 acres 2 roods 24 poles ; he wants to exchange them for a square field of inferior quality, but one half larger : required the side of the square. *Ans.* 56·28+poles.

9. A clergyman's glebe consists of 4 fields ; the 1st contains 2 acres 3 roods 4 poles,—the 2nd, 3 acres 1 rood 20 poles,—the 3rd, 1 acre 15 poles,—the 4th, 4 acres 3 roods 24 poles ; he wants a square field in exchange, equal in area to all the four : required the length of its side. *Ans.* 44·079+poles.

10. In a square plantation, containing 74,529 trees, the trees are planted 18 feet distant : required the length of the side.
Ans. 4896 feet.

Note. Circles are to each other as the squares of their diameters.

11. There are two circular walks in a gentleman's pleasure ground ; the diameter of the one is 60 yards, and the other is 5 times as large : required its diameter. *Ans.* 134·164+yards.

12. A malster has a kiln 20 feet in diameter, which is too little by $\frac{7}{8}$ of his business : what is the diameter of one which will suit his purpose ? *Ans.* 30·9838+feet.

13. The paving of a circular space of 50 feet in diameter cost £74 16s. 8d. : what will the paving of another, 120 feet in diameter, cost ? *Ans.* £431 0s. 9½d. ⅔

14. A gentleman has 2 elliptical ponds ; the area of the one is 3 acres 2 roods, the other 1 acre 2 roods 20 poles ; he wants a square canal 3 times as large as both : required the length of its side. *Ans.* 49·598+poles.

15. The Duke of Athol planted 1,332,250 trees in a grove, whose length was 10 times its breadth : required the number of trees in its length and breadth ? *Ans.* 365 trees in breadth.

III. Given any two sides of a right angled triangle, to find the other side.

Rule. To find the hypotenuse,—add together the squares of the two legs, and the square root of the sum will be the hypotenuse. To find either of the legs,—from the square of the hypotenuse subtract the square of the given leg, and the square root of the remainder will be the other leg.
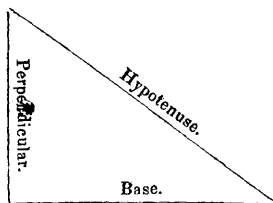
16. The three sides of a right-angled triangle are 3, 4, and 5, taking any two of them as given : required the other.

17. If the base of a right-angled triangle be 90 feet, and the perpendicular 67·5 feet : what is the length of the hypotenuse ?
Ans. 112·5 feet.

18. If the hypotenuse of a right-angled triangle be 112·5 feet, and the base 90 feet: what is the length of the perpendicular ?   *Ans.* 67·5 feet.

19. If the perpendicular of a right-angled triangle be 67·5 feet, and the hypotenuse 112·5 feet: what is the length of the base ?   *Ans.* 90 feet.

20. The length of a line stretched from the top of a steeple to a station 250 feet from its bottom, was found to measure 330 feet: query, the height of the steeple, *Ans.* 215·4+feet.

21. Standing on the side of a river, I found that a line stretched from the top of a precipice, rising perpendicularly 449 feet on the other side, measured 585 feet: required the breadth of the river.   *Ans.* 375 feet.

22. The wall of a fortification is 248 feet high, the breadth of a ditch surrounding it is 224 feet : required the length of a scaling-ladder that will reach from the farther side of the ditch to the top of the wall.   *Ans.* 334·185 feet.

23. There are 3 towns, M. N. and P., so situated that N. lies 240 miles south of M., and P. 180 miles west of M.: required the distance between N. and P.   *Ans.* 300 miles.

24. Wanting to find the height of a rock, which was nearly perpendicular, I stood 55½ yards from the bottom, and found that the distance from the place where I stood to the top of the rock was 140½ yards : required its height.
Ans. 129.07 yards.

25. A ladder 65 feet long, was standing upright against a wall of the same height ; but the workmen having occasion to go in at a window, slid the ladder 25 feet from the building in

order to accomplish their purpose : required how much the top of the ladder fell from the summit of the wall. *Ans.* 5 feet.

26. The top of a May-pole, which was broken off by a blast of wind, struck the ground 15 feet from the pole: what was the length of the whole May-pole, supposing that of the broken piece to be 39 feet. *Ans.* 75 feet.

27. The height of an elm, growing in the middle of a small circular island, 30 feet in diameter, is 53 feet, and a line stretched from the top of the tree to the outside of the water is 112 feet: what is the breadth of water surrounding the island? *Ans.* 83·6 feet.

EXTRACTION OF THE CUBE ROOT.

The cube root of any number or power is such a number as being multiplied by itself, and that product again by the same number, will produce the number first given.

RULE. Divide the number to be extracted into periods of three figures each, beginning at the units place, and pointing to the left in integers, and to the right in decimals.

Find the cube number either equal to, or the next less than the left hand period, and put its root in the quotient ; subtract the cube number from the first period, and to the difference bring down the next period for a *dividend.*

Find the divisor by multiplying the square of the number in the quotient by 300 ; consider how often it is contained in the dividend, and put the number of times in the quotient.

Multiply the number that was squared to find the divisor, by the last figure in the quotient, and that product by 30 ; add the result, together with the square of the last quotient figure, to the divisor ; multiply this sum by the last quotient figure for the *subtrahend.*

Take the subtrahend from the dividend, and to the difference bring down the next period for a new dividend. Then find a divisor in the same manner as before, and repeat the operation till all the periods are brought down.

Note. Each period of decimals must consist of 3 places, and if the given decimals have not so many, the deficiency must be supplied by annexing ciphers.

II. To extract the cube root of a vulgar fraction. Reduce the fraction to its lowest terms, and extract the cube root of the numerator and denominator for the answer ; if that cannot be done, reduce the fraction to a decimal, and extract the cube root of it.

Required the cube root of 78567733187.

```
    *4²×300=4800
    4×2×30=  240     78,567,733,187(4283 cube root.
       2²=    4     64
                    ———
  1st divisor 5044  4283×4283×4283=
                    )14567   78567733187 proof.
                     10088
                    ———

   42²×300=529200
   42×8×30=  10080
       8²=      64
               ———

  2nd divisor 539344  )4479733
                       4314752
                       ———

 428²×300=54955200
 428×3×30=    38520
      3²=        9
                 ———

  3d divisor 54993729  )164981187
                        164981187  *4² means the number
                        ————        is to be squared.
```

What is the cube root of

1. 11089567.	*Ans.* 223.	7. ·000000091125.	*Ans.* ·0045
2. 800125725.	" 928.+	8. 3.	*Ans.* 1·4422+
3. 27407028375.	" 3015.	9. 5.	" 1·7099+
4. 122615327232.	" 4968.	10. $\frac{704}{2375}$.	" $\frac{2}{3}$.
5. 4149.995543.	" 16·07	11. $\frac{3}{4}$.	" ·9085+
6. ·008730123.	" .2059+	12. 7$\frac{2}{3}$.	" 1.97+

USES OF THE CUBE ROOT.

I. To find 2 mean proportionals between 2 given numbers.

RULE. Divide the greater number by the less, and extract the cube root of the quotient; which root multiplying the less number will give the least mean proportional, and dividing the greater number will give the greatest.

1. What are the two mean proportionals between 5 and 320?   *Ans.* 20 and 80.   i. e. 5 : 20 : : 80 : 320.

2. What are the two mean proportionals between 64 and 512?   *Ans.* 128 and 256.

3. What are the two mean proportionals between 7 and 15379?   *Ans.* 91 and 1183.

II. To find the side of a cube equal in solidity to any given solid, extract the cube root of its solid content.

4. The solidity of a sphere is 11390·625: required the lineal side of a cube of equal solidity.   *Ans.* 22·5.

5. A stone of the form of a cube contains 21952 solid feet: required the area of one of its sides? *Ans.* 28×28=784 feet.

6. Required the side of a cube equal in solidity to a globe, containing 15625 cubic inches? *Ans.* 25 inches.

III. Having the dimensions of a solid body given, to find the dimensions of a similar one, any number of times greater or less.

RULE. Multiply or divide the cube of each of the given dimensions, by the number of times that the required solid is to be greater or less than the given one; then the cube root of each product or quotient will be the dimensions of the solid required.

7. A water cistern is 5 feet long, 4 broad and 3 deep: required the dimensions of another cistern that will contain 5·832 times as much?

Ans. 9 feet long, 7·2 broad, and 5·4 deep.

8. If the length of a ship's keel be 44 feet, the midship beam 15, and the depth of the hold 9: required the dimensions of another ship of the same form, that will carry 3 times the burden? *Ans.* Length of keel 63.45+, midship beam 21·63+, depth 12·98+.

Note. Similar solids are to each other as the cubes of their sides and diameters.

9. If a ball of 4 inches diameter weigh 9½lb.: required the weight of a similar one whose diameter is 7 inches.

Ans. 50·9 lb.

10. If a cube of silver, whose side is 3 inches, be worth £8 17s. 6d.: required the side of a cube of the same silver, whose value would be 3 times as much. *Ans.* 4·326+.

11. A mound of earth is 660 feet long, 120 feet broad, and 208 deep: required the side of a cubic one equal to it.

Ans. 254·44+feet.

12. If a globe of 8 inches diameter weigh 18 lbs.: what will be the diameter of another weighing 162 lb.?

Ans. 16·64+ inches.

13. The length of a stone is 8 feet, its breadth 3 inches, and its thickness 4 feet: what are the dimensions of another 10 times as large, and also the side of a cube equal to both?

Ans. 17·23 feet long, 12·92 broad, 8.61 thick ; 12·83 feet side of cube.

14. If a ship of 300 tons be 75 feet long in the keel: required the burden of a similar ship whose keel is 100 feet long.

Ans. 711·1 tons,

15.   There are 3 chests, the first contains 10,000 solid inches, the second 16,656, and the third 20,000: required the side of a cubical chest that will contain as much as all the three.

Ans. 36 inches.

POSITION.

This rule is called Position, or Supposition, because with the help of supposed numbers, and by reasoning from them according to the nature of the question, we find the true ones.

This rule is divided into two parts,—Single and Double; in the former, one supposition is used, and two in the latter.

SINGLE POSITION.

Rule.   Suppose any number at pleasure, and work with it as if it were the true one, then if the result be either too little or too much, say, as the result of the position is to the position, so is the given number to the number required.

What number is that to which if we add the half, the third, and fourth of itself, the sum will be 125 ?

Suppose it to be 24		As 50 : 24 : : 125	
$\frac{1}{2}$	12	2 12	5
$\frac{1}{3}$	8	5	
$\frac{1}{4}$	6	—	
	—	60 ans.	
	50	$\frac{1}{2}$ 30	
		$\frac{1}{3}$ 20	
		$\frac{1}{4}$ 15	
		—	
		125 proof.	

1.   A man being asked his age, said, If to my age you add $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{6}$ thereof, the number will be 63 : what was his age ?

Ans. 36 years.

2.   A jockey being asked the value of his horse, said, that if from his value you take $\frac{1}{3}$ and $\frac{1}{4}$ thereof, the remainder will be £15 : required at what he valued his horse.   *Ans.* £36.

3.   A gentleman bought a coach, two horses, and harness, for £150; the horses cost 5 times as much as the harness, and the coach as much as both horses and harness : how much did he pay for each?

Ans. Harness £12 10s., horses £62 10s., and coach £75.

4.)   Divide £1085 among 4 persons, A. B. C. and D., in such a manner that B. may have twice as much as A., C. three times as much as A., and D. five times as much as A.

Ans. A. £98$\frac{7}{11}$, B. £197$\frac{3}{11}$, C. £295$\frac{10}{11}$, and D. £493$\frac{2}{11}$.

5. Three persons, A. B. and C., discoursing upon their ages, find that A. is as old again as B., B. three times as old as C., and the sum of their ages is 210 years: required each person's age. *Ans.* A. 126, B. 63, and C. 21.

6. Required a number to which $\frac{1}{3} + \frac{1}{4}$ of itself being added, and $\frac{1}{5}$ of the sum subtracted; the remainder shall be 76.
Ans. 60.

7. A person, after spending $\frac{1}{2}$ and $\frac{1}{5}$ of his money had £72 left: what had he at first? *Ans.* £240.

8. A. B. and C. purchased a house for £800, of which A. was to pay double of B., and B. 3 times as much as C.: what should each pay? *Ans.* A. £480, B. £240, C. £80.

9. The number of fruit-trees in a garden was 252; there were $\frac{1}{3}$ more bearing apples than pears; the number of those bearing plums was $\frac{4}{5}$ of those bearing pears, and the number of those bearing cherries $\frac{4}{3}$ of those bearing plums: how many were there of each?
Ans. 80 apple, 60 pear, 48 plum, 64 cherry.

10. A young gentleman was left a fortune,—$\frac{1}{4}$ of which he spent in gambling, $\frac{1}{6}$ among his companions, $\frac{1}{12}$ on a house and furniture, $\frac{1}{12}$ on a stud of horses: he then finds that he has only £4240 remaining: what was his fortune?
Ans. £10176.

DOUBLE POSITION.

RULE. Make two positions, and proceed with each accord-ing to the nature of the question; find how much the results are different from the given number; then multiply each of these differences or errors, by the other's position, and if the errors be both too much or too little, divide the difference of the products by the difference of the errors; but if the one error be too much and the other too little, divide the sum of the products by the sum of the errors, and the quotient will be the answer.

A. B. and C. playing a game at cards for 1296 crowns, dis-agreed about the game, and the money being upon the table, each seized as much as he could; B. got 60 more than A., and C. got $\frac{1}{5}$ of both their sums: required how much each got.

Suppose A. got 200	Suppose A. got 600
B. got 260	B. got 660
C. got 92	C. got 252

552 too little by 744.   1512 too great by 216.

```
    Errors.
  — 744 × 600 =446400          A. 510 ⎫
  + 216 × 200 = 43200          B. 570 ⎬ answers.
    ———        ———             C. 216 ⎭
    960        )489600(510     ———
                               1296 proof.
```

1. What number is that, which being multiplied by 7, and lessened by 30, if the remainder be divided by 5, the quotient will be the same as the required number?   *Ans.* 15.

2. Three men, A. B. and C., have £36 to be divided among them, so that B.'s share will be £4 more than $\frac{2}{3}$ of A.'s, and C.'s £5 more than $\frac{3}{4}$ of B.'s: required their shares.

$$Ans. \text{ A. } 11\frac{1}{13}, \text{ B. } 11\frac{5}{13}, \text{ C. } 13\frac{7}{13}.$$

3. If to my age there added be,
    One-half, one-third, and three-times three,
    Six score and ten the sum will be;
    What is my age, pray shew it me?   *Ans.* 66.

4. A gentleman has two horses, Diamond and Swift, and a saddle worth £50, which, when set on the back of Diamond, makes his value double that of Swift; but when set on the back of Swift, makes his value triple that of Diamond: required the value of each horse?   *Ans.* Diamond £30, Swift £40.

5. A miser having about him a certain number of crowns, said, if $\frac{1}{6}+\frac{1}{8}+\frac{1}{9}+\frac{1}{12}$ of what he had were added to 10, the sum would be 45: how mony crowns had he?   *Ans.* 72.

6. A farmer being asked how many sheep he had, answered that he had them in five fields; in the first he had $\frac{1}{4}$ of his flock, in the second $\frac{1}{8}$, in the third $\frac{1}{6}$, in the fourth $\frac{1}{12}$, and in the fifth 450: how many had he?   *Ans.* 1200.

7. A gentleman serving some beggars, found, that if he gave each 4d. he would have 8d. left; but if he gave each 5d. he would want 4d.: how many beggars were there?
                                                          Ans. 12.

8. A fish whose head is 9 inches long, its tail as long as the head and half the body; and its body as long as both head and tail: required the whole length of the fish?
                                                          Ans. 72 inches.

9. When first the marriage knot was tied
    Between my wife and me,
    My age did her's as far exceed
    As three times three does three.
    But after ten and half ten years
    We man and wife had been,

Her age was then as near to mine
As eight is to sixteen.
  Now pray,
What were our ages on the wedding day?
     Ans. He was 45, and she 15.

10. A wine merchant mixed 60 gallons of wine, part worth 8s. per gallon, and the remainder worth 10s., so that the value of the mixture is 8s. 10d.: required the quantity of each?
     Ans. 35 at 8s., 25 at 10s.

11. A market woman bought a certain number of eggs at 2 a penny, and as many at 3 a penny, and sold them all again at the rate of 5 for 2d. ; after which she found to her surprise that she had lost 4d. by the sale : what number of eggs had she?
     Ans. 240, or 120 at each price.

12. A gentleman engaged a workman for 60 days, on condition that he should have 5s. for every day he wrought, and forfeit 2s. 6d. every day he was absent ; at the end of the engagement he received £9 : how many days was he absent?
     Ans. 16 days.

ARITHMETICAL PROGRESSION.

Arithmetical Progression is when a series or rank of numbers, uniformly increases or decreases by the continual addition or subtraction of some number called the common difference ; thus, 1, 2, 3, 4, 5, 6, 7, is an increasing arithmetical series, where the common difference is 1 ; and 12, 10, 8, 6, 4, 2, is a decreasing series, where the common difference is 2.

The first and last terms of the series are called extremes, and the other terms means.

Note. The *sum* of the extremes is equal to the sum of any two means equally distant from them.

Of these five, viz., the two extremes, common difference, number of terms, and sum of the series : having any three given, the other two may be found.

CASE I. Given the extremes and number of terms, to find the common difference, and sum of the series.

RULE. Divide the difference of the extremes by one less than the number of terms, the quotient will be the common difference. And the sum of the extremes multiplied by half the number of terms will give the sum of the series.

1. Given the extremes 9 and 48, and the number of terms 14 : required the common difference and sum of the series.
     Ans. 3 com. dif. 399 sum of series.

2. A farmer bought 100 head of cattle, and gave for the first 1s. and for the last £19 17s.: what did he give for the whole, and how much did the price of any one exceed that of the preceding?   *Ans.* 4s. dif.   £995 price.

3. A merchant was in business for 24 years ; the first year he cleared £40 and the last £500 : how much did he clear in all, and what was his yearly increase, not counting interest?
                      Ans. £20 increase, £6480 in all.

4. A person owed a certain sum, which he paid in 13 different payments, increasing in arithmetical progression ; the first payment was 3s., the last £2 11s.: how much did each payment exceed the former, and how much did he owe in all?
                      Ans. 4s. dif.   £17 11s. debt.

5. Place 100 apples in a straight line, 1 yard asunder, and the first 1 yard from a basket: how far must you run to bring them one by one to the basket, and how much farther have you to run for every successive apple?
                      Ans. 2 yards dif. and 5 miles 1300 yards in all.

Case II. Given the extremes and common difference, to find the number of terms and sum of the series.

Rule. Divide the difference of the extremes by the common difference, the quotient plus one will be the number of terms.

Divide the difference of the squares of the extremes by twice the common difference, and this quotient added to half the sum of the extremes will give the sum of the series. ,

6. Given the extremes 7 and 103, and the common difference 4; required the number of terms and sum of the series.
                      Ans. 25 no. 1375 sum.

7. A nurseryman planted a number of fruit trees in the form of an isosceles triangle ; he put 1 plant in the first row, 3 in the second, and so on in arithmetical progression ; the last row contained 61 plants: required the number of rows, and the whole number of plants.   *Ans.* 31 rows, 961 trees.

8. A lady meeting with a number of poor people, gave the first 2d., the second 5d., and so on to the last, to whom she gave 2s. 8d.: required the number of poor people, and how much the lady gave away in all?   *Ans.* 11 poor, 15s. 7d. in all.

9. An eccentric character traveling from one city to another, went 6 miles the first day, 9 the second, and so on in arithmetical progression ; his last day's journey was 60 miles : required the number of days he travelled, and the distance between the cities.   *Ans.* 19 days, 627 miles.

Case III. Given the common difference, number of terms, and sum of the series, to find the extremes.

RULE. Divide the number of terms minus 1, by 2; multiply the common difference by the quotient; add and subtract this product to and from the sum of the series divided by the number of terms; the sum and remainder will be the greatest and least terms respectively.

10.   Given the number of terms 9, the common difference 2, and the sum of the series 135: required the extremes.
<div style="text-align:right">*Ans.* 7 least, 23 greatest.</div>

11.   A person discharged a debt of £210 12s. in a year, by paying every week 3s. more than he did the preceding: what were the first and last payments?
<div style="text-align:right">*Ans.* 4s. 6d. least, 157s. 6d. greatest.</div>

12.   A courier by increasing his day's journey 3 miles per day, travels 345 miles in 15 days: required his first and last day's journey.   *Ans.* First day 2 miles, last 44 miles.

13.   A horse dealer bought ten horses for £110, the difference of their prices being £2: what did the first and last cost him?
<div style="text-align:right">*Ans.* The first £2, the last £20.</div>

CASE IV.   Given either of the extremes, the common difference, and number of terms, to find the other extreme and sum of the series.

RULE.   Multiply the common difference by the number of terms minus 1; this product, added to the less extreme, gives the greater; or, subtracted from the greater extreme, leaves the less.

Add said product to twice the least extreme, or subtract it from twice the greater; multiply the sum or the remainder by half the number of terms; either of these will give the sum of the series.

14.   Given the least extreme 12, common difference 3, and the number of terms 11: required the greatest extreme, and sum of the series?   *Ans.* 42 greatest, 297 sum.

15.   Given the greater extreme 123, common difference 5, and number of terms 24: required the less extreme, and sum of the series.   *Ans.* 8 least, 1572 sum.

16.   A sum of money was divided among 12 persons, whose shares were in arithmetical progression; the first received 3s., the second 7s., and so on: required the sum divided among them, and the share of the last.   *Ans.* £15; the last got 47s.

17.   A traveler set out on a journey which he accomplished in 15 days, by traveling every day three miles more than he did the preceding, and traveled 49 miles the last day: required how many miles he traveled the first day, and the length of the journey?   *Ans.* 7 m. first day, 420 m. in all.

GEOMETRICAL PROGRESSION.

Geometrical Progression is when any series of numbers uniformly increases or decreases by a common multiplier or divisor ; thus, 1, 3, 9, 27, 81, is an increasing series ; and 81, 27, 9, 3, 1, is a decreasing series ; 3 is the multiplier and divisor, or common *ratio*.

Note. The *product* of the extremes is equal to the product of any two means equally distant from them.

CASE I. Given the least extreme, ratio, and number of terms, to find the greatest extreme, or any distant term.

RULE. Raise the common ratio to a power less by unity than the number of the required term ; multiply that power by the least term, the product is the greatest.

1. Given the least term 3, and the ratio 2 : required the 8th term.   *Ans.* 384.

2. Given the least term 5, the ratio 3, and the number of terms 6 : required the greatest.   *Ans.* 1215.

3. A merchant bought 12 yards of cloth at the price of the last yard, reckoning 1 d. for the first, 2 d for the second, and so on in geometrical progression : required how much he paid.
                                                      Ans. £8 10s. 8d.

4. A butcher bought 15 fat oxen from a farmer, for what the last one would come to at 2d. for the first, 6d. for the second, &c. ; he thought he had made an excellent bargain, but upon applying to a friend to calculate the price, he found the farmer had been too deep for him : how much had the butcher to pay for his 15 oxen, and how much a-piece ?

Ans. £39858 1s. 6d. altogether, or £3657 4s. 1$\frac{1}{5}$d. a-piece.

CASE II. Given the extremes and the ratio, to find the sum of the series.

RULE. Multiply the last extreme by the ratio ; from this product subtract the first extreme, and divide the remainder by the ratio minus 1.

5. Given the extremes 1, and 2187, and the ratio 3 ; required the sum of the series.   *Ans.* 3280 sum of series.

6. What debt will be discharged by weekly payments, of which the first is 5s. and the last £2048, the ratio being 2 ?
                                                      Ans. £4095 15s.

7. A gentlemen, who had a daughter married on New Year's Day, gave her husband towards her portion 4s. promising to triple that sum on the first day of every month during

the year: how much had the gentleman to advance on the 1st of December, and what was his daughter's fortune altogether?
    Ans. To advance December 1st, £35,429 8s.;
                    his daughter's fortune in all, £53,144.

8. A very rich man, but not very versant in the science of numbers, purchased 1000 acres of excellent land, lying contiguous to his estate, and which he had frequently solicited the proprietor of it to sell to him, to which he at last consented upon the following terms, viz., his rich friend agreed to give him 1 sovereign in hand, promising on the same day next year to give him 2 sovereigns, on the same day the third year 4 sovereigns, and so on, always doubling his payment for 20 years: required how much the 1000 acres would cost him, not counting interest.   *Ans.* 1,048,575 sovereigns.

9. A servant agreed with a master to serve him 11 years, without any other reward than the produce of a wheat grain for the first year, that product to be sown the second year, and so on from year to year till the end of the 11th year: required the sum of the whole produce, allowing the increase to be in a tenfold proportion.
        Ans. 111111111110 grains of wheat, or 226056 bushels,
                    at 5s. per bushel=£56514 reward.

    Note. 7680 *grains of wheat fill a pint.*

MULTIPLICATION OF DUODECIMALS.

This rule is chiefly used by artificers in taking the dimensions and computing the contents of their work.

Feet multiplied by feet give feet.
Feet multiplied by inches give inches.
Feet multiplied by seconds or parts give parts.
Inches multiplied by inches give parts.
Inches multiplied by parts give thirds.
Parts multiplied by parts give fourths.

            12 fourths make 1 third.
            12 thirds make 1 part, or second.
            .12 parts   make 1 inch.
            12 inches make 1 foot.

RULE. Place feet under feet, inches under inches, &c.; then multiply the lowest denomination of the multiplicand by the highest of the multiplier, setting down the products according to the above table; proceed with the less denominations of the multiplier in the same manner.

Multiply 11 feet 5 inches   Multiply 7 feet 6 inches 4 parts
    by 7 feet 6 inches.   by 5 feet 7 inches 8 parts.

```
        ft.  in.                    ft.  in.  p.
        11   5                      7    6    4
         7   6                      5    7    8
        ───────                     ────────────
        79  11                     37    7    8
         5   8   6                  4    4    8    4
        ─────────                        5    0    2    8
                                   ──────────────────────
        85   7   6 ans.            42    5    4    6    8 ans.
```

                                        ft. in. p. ′′′ ′′′′
1.   Mult. 7 ft. 4 in. by 4 ft. 2 in.   Ans. 30   6 8
2.   "   6 ft. 7 in. by 9 ft. 3 in.   "   60 10 9
3.   "   12 ft. 5 in. by 4 ft. 9 in.   "   58 11 9
4.   "   11 ft. 10 in. by 12 ft. 10 in.   "   151 10 4
5.   "   17 ft. 9 in. by 13 ft. 6 in.   "   239   7 6
6.   "   6 ft. 4 in. 7 pts. by 6 ft. 7 in. 3 p. "   42   1 9   2 9
7.   "   26 ft. 3 in. 4 p. by 10 ft. 6 in. 7 p. " 277   2 3   11 4
8.   " 108 ft. 7 in. by 5 ft. 7 in. 8 p.   " 612   3 5   8
9.   "   20 ft. 8 in. 4 p. by 8 ft. 7 in.   " 177   7 6   4
10.   " 175 ft. 6 in. 3 p. by 16 ft.   " 2808   4
11.   "   78 ft. 11 in. 4 p. by 7 ft. 8 in. 3 p. " 606 10 7   6
12.   "   63 ft. 4 in. 8 p. by 8 ft. 9 in. 6 p. " 557   3 6   4
13.   "   91 ft. 4 in. 9 p. by 9 ft. 7 in. 9 p. " 881   7 0   9 9

CASE I.   To find the area of a board.

RULE.   Multiply the length by the mean breadth.

14.   What is the area of a board 10 feet 3 inches long, and 1 foot 6 inches broad ?   Ans. 15 feet 4 inches 6 parts.

15.   Find the content of a board 15 feet 1 inch long, and 17 inches broad   Ans. 21 feet 4 inches 5 parts.

16.   Required the content of a deal 57 feet 8 inches long, and 2 feet 7 inches 3 parts broad.   Ans. 150 ft. 2 in. 1 pt.

17.   How many superficial feet in a board 18 feet 2 inches by 2 feet 11 inches?   Ans. 52 feet 11 inches 10 parts.

18.   Required the content of a board 20 feet 4 inches long, 2 feet 6 inches broad at one end and 1 foot 10 inches at the other.   Ans. 44 feet 0 inches 8 parts.

19.   What is the area of a board 30 feet 8 inches long, and its mean breadth 3 feet 4 inches?   Ans. 102 ft. 2 in. 8 pts.

20.   Required the superficial content of a fir deal 18 feet 10 inches long, and 1 foot 4 inches 3 parts broad.
                        Ans. 25 ft. 6 in. 0½ pt.

CASE II.   To find the solid content of squared timber.

RULE.   Multiply the mean breadth by the mean thickness, and the product by the length, gives the solid content.

21. How many solid feet in a log of wood 26 feet 8 inches long, 3 feet 2 inches broad, and 2 feet 1 inch deep?
Ans. 175 ft. 11 in. 1 pt. 4′′′.

22. How many cubic feet in a stone 13 ft. 9 in. long, 2 ft. 11 in. broad, and 1 ft. 9 in. deep? *Ans.* 70 ft. 2 in. 2 pts. 3′′′.

23. Required the content of a fir log, the length 27 ft., the mean breadth 1 ft. 10 in., and the mean thickness 1¼ ft.
Ans. 61 ft. 10 in. 6 pts.

24. Required the solid content of a stone 3 ft. 11 in. thick, 7 ft. 9 in. broad, and 13 ft. 8 in. long. *Ans.* 414 ft. 10 in. 1 pt.

25. Find the content of a log of timber, its length being 25½ feet, and its mean breadth and thickness each 20 in.
Ans. 70⅚ feet.

26. Required the solid content of a log of mahogany 7 ft. 8¼ in. broad, 9 ft. 5¼ in. thick, and 58 ft. 6 in. long.
Ans. 4247 ft. 4 in. 1½ pts.

27. How many solid feet in a block of marble 4 ft. 8 in. long, 3 ft. 11 in. thick, and 2 ft. 3 in. broad?
Ans. 41 ft. 1 in. 6 pts.

28. Required the solid content of a beech log 19 ft. 4½ in. long, 2 ft. 3⅛ in. broad, and 9⅔ in. thick.
Ans. 35 ft. 4 in. 0$\frac{13}{144}$ pts.

CASE III. To find the solid content of round timber.

COMMON RULE.—Take ¼ of the mean girt, and multiply it by itself, and the product by the length for the solid content.

Note. This rule gives the content too small by 3 feet on 11, yet it is universally used in practice, and was originally introduced to compensate the purchaser of round timber for the waste occasioned by squaring it. The true *Rule*, though never used, is—Take one fifth of the girt and multiply it by itself, and the product by twice the length for the true content.

29. Find the content of a piece of round timber, its length being 10 feet, and its mean girt 60 inches. *Ans.* 15⅝ feet.

30. How many solid feet are in a tree, its length being 25 feet and its mean girt 6 feet? *Ans.* 56¼ feet.

31. Required the content of a tree 24 feet long, and its girts at the ends 14 and 2 feet. *Ans.* 96 feet.

32. How many solid feet in a tree 26 ft. 3 in. long, and its mean girt 6 feet? *Ans.* 59 ft. 0 in. 9 pts.

33. Required the content of a tree 48 ft. long, and its girts at the ends 60 and 18 inches. *Ans.* 31·6875 feet.

EXERCISES IN ARTIFICERS' MEASURING.

Note.· 36 square yards are termed a rood of building, and 100 square feet are called a square of flooring.

The standard thickness for brick walls is 3 half bricks, and for stone walls 2 feet.

1. Find the expense of ceiling a room at 6d. per yard, the length being 20 ft. 9 in. and breadth 15 ft. 4 in.
<div align="right">*Ans.* 17s. 8$\frac{1}{9}$d.</div>

2. What will be the expense of painting the outside of 5 windows, each 6 feet 3 in. by 3 ft. 8 in., at 7d. per yard, to be paid for as work and quarter ?   *Ans.* 9s. 3$\frac{1}{4}$d.

3. Find the expense of glazing a window, at 1s. 6d. per foot, its daylight measure being 5 ft. 11 in. by 3 ft. 5 in.
<div align="right">*Ans.* 30s. 3$\frac{3}{4}$d.</div>

4. A log of wood, 14 ft. 10 in. long, was sawed into 7 deals, each 2 ft. 11 in. broad: how many square feet did they contain ?
<div align="right">*Ans.* 302 ft. 10 in. 2 pts.</div>

5. What is the solid content of a box, 7 ft. 9 in. 3 pts. long, 2 ft. 3 in. 6 pts. broad, and 1 ft. 11 in. 11 pts. thick ?
<div align="right">*Ans.* 35 ft. 5 in. 10$\frac{1085}{1152}$ pts.</div>

6. A window measures 7 ft. 8 in. 6 pts. by 4 ft. 9$\frac{2}{3}$ in.: how many square feet does it contain ?   *Ans.* 37 ft. 0 in. 6$\frac{1}{6}$ pts.

7. What is the expense of a common brick floor, measuring 35 ft. 5 in. by 34 ft. 11 in., at 2s. 2d. per square yard ?
<div align="right">*Ans.* £14 17s. 8$\frac{1}{4}$d.</div>

8. What is a marble slab worth, whose length is 5 ft. 7 in. and breadth 1 ft. 10 in., at 6s. per foot ?   *Ans.* £3 1s. 5d.

9. A round pillar is to be painted, whose height is 18 ft. 4 in., and the girt 10 ft. 6 in.: how many square yards are in it ?
<div align="right">*Ans.* 21 yds. 3 ft. 6 in.</div>

10. What is the difference of the areas of the floors of two rooms, the one 42 ft. 8 in. by 30 ft. 2 in., the other 28 ft. 5 in. by 19 ft. 7 in.?   *Ans.* 730 ft. 7 in. 5 pts.

11. The canal which joins the Forth and Clyde is 27 miles long, 36 feet broad, and mean depth 7 feet: required the number of cubical yards of excavation.   *Ans.* 1,330,560 c. yds.

12. How many bricks will build a wall 60 feet long, 8 feet high, and two bricks thick, at the rate of 140 bricks per standard square yard ?*   *Ans.* 9955$\frac{5}{9}$.

---

* To reduce a brick wall of any thickness to standard thickness, multiply by the number of half bricks in the thickness, and divide by 3.

13. How many square yards of standard brick-work are in a wall, 40 ft. 6 in. long, 22 ft. 9 in. high, and 2½ bricks thick ; and what is the expense of the materials and workmanship, at 8s. 6d. per square yard?   *Ans.* 170⅝ yds.; £72 10s. 3¾d.

14. What length of a stone wall, which is 4 feet high, will make a rood ?   *Ans.* 81 feet.

15. What will be the expense of lining a water cistern 2 ft. 10 in. long, 2 ft. 6 in. deep, and 2 ft. broad, with sheet lead, 10 lb. to the square foot, at £1 18s. 9d. per cwt.?
                         Ans. £5 3s. 2½d. 1³⁄₂₈

16. How many square yards of standard brick-work in a wall 75 feet long, 15 ft. 9 in. high, and three bricks thick ?
                         Ans. 262 yd. 4 ft. 6 in.

17. What is the value of 5 oak planks, at 1s. 9d. per foot, each 17 ft. 6 in. long, and whose breadths are, two of them, each 1 ft. 1 in. 6 pts. in the middle ; the third 1 ft. 6 in. in the middle ; the fourth 11 in. 3 pts. ; and the fifth 1 ft. 2 in. 3 pts.?
                         Ans. £3 19s. 11d.

18. Find the expense of digging a cellar, the length of which is 40 ft. 4 in., breadth 25 ft. 7 in., and depth 9 ft. 9 in., at 6d. per solid yard.   *Ans.* £9 6s. 3½d.

19. A piece of ground, measuring 25 ft. 3 in. by 6 ft. 7 in., is to be paved with stones, each measuring 1 ft. 5 in. by 8 in.: how many stones will it require, and what will be the expense at 1s. 6d. per square foot? *Ans.* 176 ¹⁄₁₃₆ stones; £12 9s. 4½d.

20. How much plastering on a partition 7 ft. 8 in. long, and 10 ft. 3 in. high, deducting a door 6 ft. 3 in. by 2 ft. 10 in.; and what will it cost at 5d. per square yard?
                Ans. 6 yd. 6 ft. 10½ in.; cost 2s. 9¾d. ⁵⁄₁₈

21. One has paved a rectangular court yard, 42 feet 9 inches in breadth, and 68 feet 6 inches in length ; and in it he has laid a foot way the length of the court yard, and 5 feet 6 inches broad ; the foot way is laid with purbeck stone, at 3s. 6d. per yard, and the rest with pebbles at 3s. per yard: what will the whole come to ?   *Ans.* £49 17s. 0½d.

See Appendix No. 5.

TO FIND THE TONNAGE OF SHIPS.

RULE. Multiply the length of the keel, taken within the vessel, or as much of the ship as treads upon the ground, by the length of the midship beam, taken also within, from plank to plank, and that product by half the breadth, taken as the depth ; then divide the last product by 94, and the quotient will give the tonnage.

1. If the length of a ship's keel be 80 feet, and the midship beam 30 : required the tonnage. *Ans.* $382\frac{46}{47}$.

2. If the length of a ship's keel be 87 feet 6 inches, and the midship beam 28 feet 8 inches : required the tonnage.

Ans. $382\frac{403}{846}$.

3. What is the tonnage of a ship whose keel is 160 feet, and midship beam 30 ? *Ans.* $765\frac{45}{47}$.

PERMUTATION

Is a name given to the number of changes of order or position, of which two or more things are susceptible.

RULE. Multiply all the terms of the natural series of numbers, from one up to the given number of things, continually together, for the number of permutations required.

1. How many changes can be rung on a chime of 8 bells ?
$1\times2\times3\times4\times5\times6\times7\times8=40320$ ans.

2. How many permutations can be made of the 9 digits ?
Ans. 362880.

3. How many permutations can be made of the letters in the word *authorised* ? *Ans.* 3628800.

4. How many changes can be rung on 12 bells, and how long would it take to ring them at 10 per minute, counting the year 365 days 6 hours ?
Ans. Changes 479001600 ; time 91+years.

MISCELLANEOUS EXERCISES.

1. A gentleman has a garden in the form of a parallelogram, whose dimensions are 64 fathoms by 36 ; he intends to have a square one of the same area : required the side of the square.
Ans. 48 fathoms.

2. 90 may be so divided that the first part increased by 2, the second diminished by 2, the third multiplied by 2, and the fourth divided by 2, shall all be equal : required these parts.
Ans. 18, 22, 10, 40.

3. I have received advice from my factor, that he has disbursed on my account the sum of 4000 guilders 15 stivers : I demand what sum I must remit for that in English money, exchange 33s. 4d. flemish per £ sterling, and also what his commission comes to at 2 per cent. ?
Ans. £400 1s. 6d. ; com. $£8\frac{3}{2000}$.

4. There are two towers on a plain, the one 240 feet high, and the other 180 ; a ladder placed in the line of distance between them, 215 feet from the bottom of the lowest, will touch

the top of both towers: required the length of the ladder, and the distance between the towers.

$\quad$ *Ans.* 280·4+feet, length of ladder; 360 feet distance.

5. If a ship of 72 tons burden be 45 feet long in the keel, 17·3 in breadth, 8·7 in depth: required the dimensions of a similar ship that will carry 5 times as much.

$\quad$ *Ans.* Length 76·94+, breadth 29·58+, depth 14·87+.

6. A court yard is 50 feet long, and 40 feet 6 inches broad: what will the paving of it cost, at 3s. 7½d. per square yard?

$\qquad$ *Ans.* £40 15s. 7½d.

7. If a house have 3 tier of windows, 4 in a tier, and if the height of the first tier be 6 feet 3 inches, of the second 5 feet 4 inches, and of the third 4 feet 9 inches, and the breadth of each 3 feet 6 inches: what will the glazing come to, at 15d. per foot?

$\qquad$ *Ans.* £14 5s. 10d.

8. A gentleman, on his travels, received at Paris 12250 francs for a bill of exchange, the value of which in England was £500: what was the course of exchange between England and France?

$\qquad$ *Ans.* 24 francs 50 cents.

9. A square plantation, where the trees are 12 feet distant, contains 108900 trees: what is the length of the side, and how many acres does it contain? *Ans.* 1316 yards, 357$\frac{497}{605}$ acres.

10. There are two circular ponds in a gentleman's pleasure ground; the diameter of the smaller is 100 feet, and the greater is three times as large: what is its diameter?

$\qquad$ *Ans.* 173·2+feet.

11. There are two columns in the ruins of Persepolis left standing upright; the one is 64 feet above the plain, and the other 50; in a straight line between these two stands an ancient small statue, the head of which is 97 feet from the summit of the higher and 86 feet from the top of the lower, the distance of the base of which column from the centre of the statue's base is 76 feet: required the distance between the tops of the columns.

$\qquad$ *Ans.* 157+feet.

12. What will the digging of the foundation of a house 68 feet long, 33 feet broad, and 5 feet deep, come to, at 1s. 3d. per solid yard?

$\qquad$ *Ans.* 415$\frac{5}{9}$ yd., £25 19s. 5$\frac{1}{3}$d.

13. How many yards of painting in a room 45 feet 6 inches long, 24 feet 10 inches broad, and 13 feet 4 inches high, and how much will it cost, reckoning the white-washing of the ceiling at 1½d. per square yard, and the rest at 10½d. per square yard?

$\quad$ *Ans.* Ceiling 125 yd. 4 ft. 11 in.=15s. 8¼d. $\frac{5}{18}$, walls 208 yd. 3 ft. 6$\frac{2}{3}$ in.=£9 2s. 4d. $\frac{16}{27}$, or cost in all £9 18s. 0¼d. $\frac{47}{54}$.

14. If a ball, 6 inches diameter, weigh 13½ lb.: what will be the diameter of a ball that weighs 62½ lb.? *Ans.* 10 inches.

15. If a ship's keel be 125 feet long, the midship beam 25, and the depth of the hold 15: required the dimensions of another ship of the same form, that will carry but half the quantity.

Ans. Length of keel 99·2+ft., midship beam
                    19·84+feet, depth of hold 11·9+feet.

16. One being asked his age, said, if ⅗ of the time I have lived be multiplied by 8, and ⅝ of the product be divided by 4, the quotient will be 42: what was his age? *Ans.* 56.

17. A gentleman sent an order to his grocer for 1 cwt. sugar, at 10d. per lb.; the grocer has none at that price, though plenty at 7d. 8d. and 11d. per lb.: how many lbs. at each of these prices must he mix together to execute the order?

Ans. 16 lb. at 7d., 16 lb. at 8d., and 80 lb. at 11d.

18. A gentleman bought a house, with a garden, and a good horse in the stable, for £500 ; now he paid 4 times the price of the horse for the garden, and 5 times the price of the garden for the house : what did the house, the garden, and the horse, severally cost him ?

Ans. The house £400, the garden £80, the horse £20.

19. How many days can a company of 12 persons sit in a different position round a table at dinner; and what would be the whole expense, supposing each dinner cost 32s. 6d.?

Ans. 479001600 days, £778377600 expense.

20. An Indian, named Sessa, having invented the game of chess, shewed it to his king, who, being highly pleased with it, bid him ask what he would have for the reward of his ingenuity. Sessa, with great modesty, asked, that for the first little square of the chess board he might have one grain of wheat given him, for the second two, and so on, doubling continually according to the number of squares on the board, which were 64 ; the king, who intended him a noble reward, was displeased that he asked what he thought such a trifle ; but Sessa declaring he would be contented with it, it was ordered to be given him ; the king was astonished when he found that this would raise so vast a quantity, that the whole world could not produce it: required the number of grains, and what they would amount to at 10s. 3¾d. per bushel.

Ans. 18446744073709551615· grains, at 10s. 3¾d.
            per bushel, come to £19351404648857 11s. 10½d.

Note. 7680 grains of wheat fill a pint.

QUESTIONS FOR EXAMINATION.

What is meant by exchange? What do you mean by the par of exchange? What do you mean by the course of exchange? Is the course of exchange not always the same as the par of exchange? What is the meaning of agio? of usance? What do you mean by days of grace? How does Britain exchange with Holland? with Hamburgh? with France? with Spain? with Portugal? with Denmark and Norway? with Prussia and Poland? with Russia? with Sweden? with the United States of America? with Canada? Are usance and days of grace different in all these countries? What is the meaning of Alligation? What is the meaning of Involution? What is the meaning of Evolution? What do you mean by the square root? What do you mean by the cube root? Why is the rule of position so called? What is Arithmetical Progression? Mention an increasing series in Arithmetical Progression;—a decreasing series. What is Geometrical Progression? Name an increasing series in Geometrical Progression; —a decreasing series. What is the use of Multiplication of Duodecimals? How is the tonnage of ships found? What is meant by Permutation?

APPENDIX No. I.

BOOK-KEEPING BY SINGLE ENTRY.

In Book-keeping by Single Entry, only two books are necessary;—the *Day-Book* and the *Ledger*.

In the Day-Book are recorded, promiscuously as they happen, what goods are sold on credit, and what money or goods are received.

In the Ledger are inserted the several accounts belonging to each person, which lay dispersed in the Day-Book, and are arranged in their proper order of Dr. and Cr.: the left hand side of every folio being appointed for the Dr. and the right for the Cr. An Index is prefixed to the Ledger, containing the names of the persons whose accounts are in it.

DIRECTIONS FOR THE LEARNER.

Copy into the Day-Book one month's accounts, and calculate them by their proper rules. Then begin with the first account of the Day-Book, and post it into the Ledger, leaving a space below it to contain more accounts; if Dr., write on the Dr. side *To Goods*, or *Cash;* if Cr., write on the Cr. side *By Goods*, or *Cash;* next enter the name in the index under the first letter of the surname; and lastly, write the figure denoting the folio of the Ledger, where it is placed opposite to the account in the Day-Book. Do the same with all the first month's accounts, and then copy the second month's into the Day-Book, and calculate and post them in the same manner; and proceed thus until the whole be finished.

Note. Before posting an account, look into the index, to see if the name be there; if it is, post the account in the space below it; and should any space be filled up, you must open a new account, and transfer the balance of the former one to it.

Besides the Day-Book and Ledger, merchants, even in a retail business, find it convenient and useful to keep some subordinate or subsidiary books, viz., a *Cash-Book;* in which are entered, on the left hand or Dr. side, all sums of money received; and on the right hand, or Cr. side, all sums of money paid away. An *Invoice-Book;* into which are transcribed all invoices of goods received, &c. A *Bill-Book;* in which are recorded the parties to each bill, its date, term, and other particulars concerning it, in distinct columns.

(1.)

	£	s.	d.

_____ Toronto, Jan. 1, 1846. _____

William Johnson, Dr.   1
  29 bushels wheat .... @ 12s. 6d.
  72½   do.   malt .... @ 10s. 2d.
  41   do.   barley .... @ 5s. 1d.
  67   do.   oats .... @ 4s. 0d.

	78	16	0

_____ *"* _____

Robert Jenkinson, Dr.   1
  1074 yds. brown cloth .... @ 4s. 6¼d. | 242 | 15 | 4½ |

_____ *"* _____

Joseph Wakefield, Dr.   1
  4½ lb. green tea .... @ 10s. 0d.
  9¾ lb. bohea .... @ 9s. 10d.
  6 oz. nutmegs .... @ 0s. 6½d.
  10¼ oz. black pepper .... @ 0s. 2¼d.
  19½ lb. soap......................... @ 0s. 10d.

	8	2	3½

_____ 15 _____

Jonathan Winterton, Dr.   1
  5¼ gallons brandy .... @ 26s.
  14½   do.   red port.................. @ 18s.
  13   do.   Malaga .... @ 20s.
  17¾   do.   Lisbon .... @ 19s.
  7   do.   Mountain .... @ 21s.

	57	1	9

_____ 24 _____

Henry Goodfellow, Dr.   1
  6 gallons rum .... @ 18s.
  10¾   do.   gin .... @ 26s.

	19	7	6

	£	s.	d.
_____ Toronto, Jan. 26, 1846. _____			
Andrew Tomlinson, Dr. 1			
11 pair black silk stockings...... @ 18s. 0d.			
9 pair white silk stockings ..... @ 24s. 0d.			
19 pair worsted stockings......... @ 4s. 0d.			
17 pair cotton stockings .... @ 5s. 6d.			
_____ " _____	29	3	6
John Westerly, Esq., Dr. 2			
27 pair harrateen hangings...... @ 96s. 10d.			
19 pair cotton hangings .... @ 59s. 4d.			
_____ 28 _____	187	1	10
Joshua Housekeeper, Dr. 2			
27 bush. 3 pks. pease ...... @ 9s. per bush.			
4 bush. 2½ pks. tares ...... @ 14s. do.			
_____ Feb. 1. _____	15	14	6
Humphrey Armstrong, Dr. 2			
7 thousand quills ...... @ 2s. 9d. per hund.			
21 reams paper .... @ 1s. 3d. per quire.			
_____ 8. _____	35	17	6
Thomas Barrowman, Dr. 2			
17 stones soap .... @ 10d. per lb.	9	18	4
_____ 15. _____			
Mrs. Arabella Farmer, Dr. 2			
19¾ yards Flanders lace .. .. @ 12s. 10d.			
30 yards ribbon .... @ 1s. 1½d.			
4 fans .... @ 5s. 6d.			
9 sarcenet hoods .... @ 8s. 11d.			
_____ 21. _____	19	9	5½
Lord George Mountain, Dr. 3			
17 hhds. wine .... @ £54 1s. 6d.	919	5	6

(3.)

	£	s.	d.
_____Toronto, Feb. 21, 1846. _____			
Lady Lustring, Dr. 3			
6 pair lamb gloves .... @ 2s. 3½d.			
8 pair kid gloves .... @ 2s. 6d.			
24¼ yards muslin .... @ 6s. 10d.			
	9	19	5½
_____ 24. _____			
Miss Louisa Darlington, Dr. 3			
17¾ yards red silk .... @ 10s. 2d.			
20 yards brocaded satin .. .. @ 19s. 6d.			
14¼ yards flowered silk... . ... @ 6s. 9d.			
8 yards black silk .... @ 4s. 2d.			
20½ yards silk damask .... @ 16s. 10d.			
	51	18	9
_____ Mar. 4._____			
Joseph Wilmot, Dr. 3			
8 stones bacon................. @ 10d. per lb.	4	13	4
_____ 15. _____			
Sir Henry Greatman, Dr. 4			
4 table sets China .... @ 54s. 9d.			
2½ dozen plates .... @ 55s. 0d.			
14 coffee cups .. .. @ 10s. 6d. per doz.			
7 large dishes .... @ 14s. 10d.			
	23	12	7
_____ " _____			
Gregory Emerson, Dr. 4			
28 English Readers .... @ 2s. 3½d.			
16 Euclid's Elements .... @ 7s. 6d.			
	9	4	2
_____ 23. _____			
Gregory Emerson, Dr. 4			
32 bushels wheat .... @ 12s 6d.	20	0	0

		£	s.	d.
_____ Toronto, Mar. 30, 1846. _____				
James Newcastle, Dr.	4			
17 doz. penknives .... @ 15s. 0d.				
29 fire-shovels .... @ 3s. 7d.				
16 candlesticks .... @ 6s. 1½d.				
		22	16	11
_____ Apr. 4. _____				
Alexander Penrith, Dr.	4			
96½ yards Nankeen .... @ 2s. 4d.				
33½ yards superior blue cloth ... @ 38s. 0d.				
27½ yards superior drab cloth ... @ 34s. 0d.				
24 yards superior red cloth...... @ 63s. 0d.				
_____ 10. _____		197	5	2
Cr. Thomas Barrowman.	2			
By cash in full		9	18	4
_____ 16. _____				
Miss Louisa Darlington, Dr.	3			
33¼ yards figured silk .... @ 8s.		13	6	0
_____ 20. _____				
Mrs. Arabella Farmer, Dr.	2			
120 yards ribbon .... @ 0s. 7½d.				
36 yards camlet.. .... @ 1s. 9d.				
36 yards crape .... @ 1s. 8d.				
60 yards bombazine .... @ 4s. 0d.				
40 yards grey stuff .... @ 1s. 9d.				
_____ 25. _____		25	8	0
William Ogle, Dr.	5			
28½ yards superfine blue cloth ...... @ 38s.				
15¼ yards superfine blue grey ...... @ 34s.				
28½ yards superfine raven grey ...... @ 34s.				
		128	10	6

(5.)

_____Toronto, April 27, 1846. _____

		£	s.	d.

Sir Henry Greatman, Dr.   4
  A silver cup, wt. 47 oz. 16 dwt. @ 7s. 6d. per oz.
  A silver punch bowl, wt. 16 oz. 17 dwt. 12 gr.
      @ 6s. 10¾d. ....
  3 doz. spoons, wt. 30 oz. 18 dwt. @ 7s. 2d. ...
  3 candlesticks, wt. 51 oz. 4 dwt. 6 gr. @ 7s. 5d.
  10 plates, wt. 67 oz. 13 dwt. @ 6s. 7d. ....

_____ 29. _____ | | 76 | 1 | 5 |

Cr. Lord George Mountain.   3
  By a bill on Messrs. Douglas & Co............   250 | 0 | 0

_____ ʺ _____

Lady Lustring, Dr.   3
  20 yards calamanco .... @ 1s. 5d.
  25 yards Persian .... @ 3s. 6d.
  21 yards lawn .... @ 7s. 6d.
  22 yards cambric..................... @ 18s.

_____ May 1. _____ | | 33 | 9 | 4 |

George Trader, Dr.   5
  894 yards check .... @ 1s. 0d.
  183 yards check .... @ 1s. 2d.
  434 yards check .... @ 1s. 1d.
  253 yards check .... @ 1s. 1¼d.

_____ 4. _____ | | 93 | 2 | 3½ |

Cr. William Johnson.   1
  By cash............................ .....£78 0 0
  By abatement .... 0 16 0 | 78 | 16 | 0 |

_____ ʺ _____

Nicholas Cheesemonger, Dr.   5
  3 cwt. 2 qr. 17 lb. Cheshire cheese @ 84s. per cwt.
  1 cwt. 3 qrs. 14 lb. Gloucester do. @ 74s. 8d.
  4 cwt. 0 qrs. 16 lb. Suffolk   do. @ 65s. 4d.
  6 cwt. 2 qrs. 20 lb. Yorkshire do. @ 56s. 0d. | 54 | 11 | 5 |

(6.)

		£	s.	d.
_____ Toronto, May 6, 1846. _____				
Moses Greenwell, *Dr.*	5			
31 yards worsted white shag ... @ 1s. 9d.				
30 yards worsted blue shag ...... @ 1s. 10d.				
30½ yards worsted blue shag ...... @ 1s. 11d.				
31 yards worsted scarlet shag... @ 2s. 8d.				
16 yards worsted blue hair shag @ 5s. 9d.				
		17	2	4½
_____ 12. _____				
Miss Louisa Darlington, *Dr.*	3			
24 yards ducape .... @ 7s. 6d.				
11 yards brocade .... @ 9s. 8d.				
10½ yards lustring..................... @ 5s. 3d.				
4½ yards Persian .... @ 1s. 9d.				
		17	9	4
_____ 19. _____				
Joseph Wakefield, *Dr.*	1			
4 lb. green tea .... @ 10s. 0d.				
12 lb. bohea .... @ 10s. 0d.				
9 lb. pepper........................... @ 2s. 9d.				
8¼ lb. coffee .... @ 2s. 9d.				
7 lb. raisins........................... @ 1s. 6d.				
		10	17	11¼
_____ 27. _____				
Cr. Robert Jenkinson.	1			
By cash in full		242	15	4½
_____ June 6._____				
Joshua Housekeeper, *Dr.*	2			
6 qrs. oats .... @ 4s. 0d. per bush.				
18 bush. pease .... @ 9s. 0d. do.				
12 bush. beans .... @ 7s. 6d. do.				
19 bush. tares .... @ 14s. 0d. do.				
7 qrs. malt .... @ 10s. 2d. do.				
15 lb. hops.................. @ 1s. 5d per lb.				
		65	0	7

(7.)

		£	s.	d.
_____Toronto, June 11, 1846. _____				
Erasmus Gordon, Dr.	5			
14 cwt. flax .... @ 12s. per stone		67	4	0
_____ " _____				
Cr. Humphrey Armstrong.	2			
By cash in full		35	17	6
_____ 19. _____				
William Johnson, Dr.	1			
6 lasts barley .... @ 5s. 1d. per bush.		122	0	0
_____ 25. _____				
Andrew Harrison, Dr.	6			
27 calf skins .... @ 7s. 0d.				
75 sheep skins .... @ 3s. 6d.				
36 sheep skins .... @ 3s. 9d.				
15 buck skins .... @ 21s. 0d.				
17 Russia hides.. .... @ 20s. 0d.				
120 lamb skins .... @ 2s. 4d.				
		76	1	6
_____ July 7. _____				
John Montague, Dr.	6			
19 gallons gin .... @ 6s. 6d. per qt.				
20 ankers brandy......... @ 25s. per gal.				
_____ 12. _____		274	14	0
Thomas Merchant, Dr.	6			
1 cwt. 2 qr. 18 lb. pepper... @ 3s. 4d. per lb.				
0 cwt. 3 qr. 14 lb. cloves .. @ 16s. do.				
30 cwt. 1 qr. 7 lb. raisins.. @ 140s. per cwt.				
4 cwt. 2 qr. 19 lb. soap.... @ 93s. 4d.				
_____ 14. _____		343	7	7
Joshua Housekeeper, Dr.	2			
27 dozen lb. candles .... @ 10d. per lb.		13	10	0

		£	s.	d.
———— Toronto, July 14, 1846. ————				
Cr. Sir Henry Greatman.	4			
By 14 lasts wheat.... @ 11s. 9d. per bush.				
By 20 lasts wheat.... @ 12s. 6d. per bush.				
———— 20. ————		1658	0	0
Lord George Mountain, Dr.	3			
6 puncheons rum...... @ 17s. 9d. per gal.		447	6	0
———— *"* ————				
Miss Louisa Darlington, Dr.	3			
10¾ yards satin .... @ 9s. 6d.				
15 yards brocade............. @ 10s. 8d.				
11 scarfs.................... @ 10s. 0d.				
14 yards Genoa velvet .... @ 17s. 4d.				
10 yards lustring............. @ 5s. 2d.				
———— 26. ————		33	6	5½
Cr. Henry Goodfellow.	1			
By cash in full.........................		19	7	6
———— *"* ————				
George Candlestick, Dr.	6			
6½ tons tallow .... @ 7s. 4d. per st.		381	6	8
———— Aug. 1. ————				
Joseph Wilmot, Dr.	3			
30 st. 12 lb. bacon...... @ 10s. 8d. per st.				
13 firkins butter........ @ 54s. 6d. per fir.				
———— *"* ————		51	17	7½
William Ogle, Dr.	5			
43¾ yards broadcloth .... @ 35s.				
100⅞ yards common yard wide .... @ 8s.				
72 yards fine narrow......... @ 11s.				
24 yards superfine blue .... @ 38s.				
		202	2	3

(9.)

	£	s.	d.
_____ Toronto, Aug. 4, 1846. _____			
Thomas Merchant, Dr. 6			
10 cwt. 3 qr. 18 lb. sugar .... @ 79s. 6d.			
1 cwt. 1 qr. 17½lb. tea ...... @ £39 12s. 0d.			
15 cwt. 0 qr. 17½lb. raisins......... @ 93s. 4d.			
8 cwt. 0 qr. 14 lb. hops .... @ 113s. 9d.			
_____ 10. _____	215	19	11
Sir Henry Greatman, Dr. 4			
10 oz. 14 dwt. 8 gr. gold-plate @ £5 14s. 9d.			
per oz. ....,..........	61	9	8½
_____ " _____			
Cr. Jonathan Winterton. 1			
By cash in full .....,.........................	57	1	9
_____ 14. _____			
James Newcastle, Dr. 4			
5 doz fine steel snuffers @ 8s. 6d. per pair			
2½ doz. London razors ... @ 2s. 4d. each			
6¾ doz. Kentish hammers @ 19s. per doz.			
_____ 20. _____	35	8	3
Cr. John Westerly, Esq. 2			
By cash in part ....,.......	100	0	0
_____ 24. _____			
Joshua Housekeeper, Dr. 2			
20 blue quilts.................... @ 10s. 11¾d.			
9 chintz quilts .... @ 24s. 9d.			
15 pair blankets..........,...... @ 17s. 8½d.			
_____ Sept. 6. _____	35	7	11½
Cr. Mrs. Arabella Farmer. 2			
By cash in full	44	17	5½

M

	£	s.	d.
_____ Toronto, Sept. 6, 1846. _____			
Joshua Housekeeper, Dr. 2			
181 bushels oats........................... @ 4s.			
417 bushels barley .... @ 5s.			
_____ 10. _____	140	9	0
Sir Henry Greatman, Dr. 4			
32⅙ hhds. beer (54 gal.) ... @ 1s. 6d. per gal.			
19 gals. gin.................. @ 6s. 6d. per qt.			
_____ 12. _____	154	15	0
Cr. John Westerly, Esq. 2			
By cash in full	87	1	10
_____ 16. _____			
Nicholas Cheesemonger, Dr. 5			
2 cwt. 1 qr. 7 lb. Cheshire ... @ 84s. per cwt.			
3 cwt. 0 qr. 19 lb. Gloucester @ 74s. 8d. do.			
6 cwt. 1 qr. 16 lb. Stilton ... @ 149s. 4d. do.			
7 cwt. 0 qr. 14 lb. Suffolk ... @ 65s. 4d. do.			
_____ 17. _____	92	11	1
Miss Louisa Darlington, Dr. 3			
69¾ yards diaper........................... @ 4s.	13	19	0
_____ 20. _____			
Joseph Wakefield, Dr. 1			
60 lb. tea .... @ 7½d. per oz.	30	0	0
_____ " _____			
Cr. Joseph Wilmot. 3			
By cash in full	56	10	11½
_____ 27. _____			
James Newcastle, Dr. 4			
5 qrs. oats .... @ 4s. 0d. per bush.			
7 qrs. bran .... @ 1s. 10d. do.			
9 bush. beans........... @ 7s. 6d. do.			
19 bush. tares .... @ 14s. do.			
16 bush. peas .... @ 9s. do.			
	37	0	2

(11.)

	£	s.	d.
_____ : Toronto, Oct. 2, 1846. _____	3		
Lord George Mountain, Dr.			
25 oz. 10 dwt. 10 gr. silver plate... @ 7s. 9d.			
85 oz. 14 dwt. 15 gr. do. ... @ 6s. 6d.			
29 oz. 16 dwt. 15 gr. do. ... @ 6s. 4d.			
_____ 3. _____		47	3	10½
Alexander Penrith, Dr.	4		
18⅝ yards scarlet .... @ 30s. 6d.			
200 yards shalloon............. ... @ 1s. 2½d.			
12 doz. twist buttons .... @ 1s. 6d.			
_____ 5. _____		41	7	8¾
Cr. George Trader.	5		
By cash in part		38	10	0
_____ " _____			
Lady Lustring, Dr.	3		
6¼ yds. ducape .... @ 6s. 4d.			
53½ yds. brocade .... @ 8s. 10d.			
71⅓ yds. Persian .... @ 1s. 2½d.			
21⅜ yds. lustring .... @ 5s. 3d.			
_____ 8. _____		35	7	0
George Trader, Dr.	5		
19 stones leather .... @ 2s. 6d. per lb.		33	5	0
_____ " _____			
Cr. Joshua Housekeeper.	2		
By cash in part......................................		182	12	10
_____ 10. _____			
Thomas Merchant, Dr.	6		
45 cwt. 1 qr. 10 lb. sugar ... @ 84s. per cwt.		190	8	6
_____ 12. _____			
Sir Henry Greatman, Dr.	4		
184⅔ gal. Mountain wine .... @ 18s.		165	18	9

M 2

		£	s.	d.
————— Toronto, Oct. 16, 1846. —————	1			
Cr. Joseph Wakefield.				
By cash in part		40	0	0
————— *"* —————	1			
Andrew Tomlinson, Dr.				
15 pair cotton hose .... @ 3s. 7d.				
12 pair worsted hose............... @ 3s. 10d.				
18 pair strawberry.................... @ 4s. 0d.				
16 pair silk gloves................... @ 5s. 11½d.				
74 pair Norwich hose .... @ 2s. 6d.				
11 pair silk hose..................... @ 16s. 6d.				
————— 18. —————		31	13	7
Cr. John Montague.	6			
By cash in full		274	14	0
————— *"* —————	6			
Cr. Thomas Merchant.				
By 19 cwt. 3 qr. hops .... @ 105s. 10d.				
By 10 cwt. 1 qr. hops .... @ 99s.				
————— 20. —————		155	4	11½
Miss Louisa Darlington, Dr.	3			
17 ells Flem. 1 qr. Flanders lace @ 17s. 5¼d.		15	2	3
————— 30. —————				
Cr. George Candlestick.	6			
By 131 yds. 1 qr. Irish linen ...... @ 4s. 8¼d.				
By 87 yds. 1 na. muslin............ @ 8s. 7¼d.				
————— Nov. 1. —————		68	4	3¼
Cr. William Ogle.	5			
By 37 qr. 7 bush. oats .... @ 32s.		60	12	0
————— *"* —————				
Cr. Lady Lustring.	3			
By cash in full		78	15	9½

(13.)

	£	s.	d.
———— Toronto, Nov. 1, 1846. ————			
Cr. Miss Louisa Darlington. 3			
By cash in part	100	0	0
———— 7. ————			
Joshua Housekeeper, Dr. 2			
28 cwt. 2 qr. 17 lb. sugar ...... @ 79s. 4¾d.	113	14	9¾
———— " ————			
Cr. Joseph Wholesale, Esq. 6			
By 420 yds. broad cloth .... @ 30s.	630	0	0
———— 10. ————			
Cr. Moses Greenwell. 5			
By cash in full	17	2	4½
———— 12. ————			
Lord George Mountain, Dr. 3			
112 lb. coffee .... @ 5s. 4d.			
52 st. sugar .... @ 7s. 6d.	49	7	4
———— 15. ————			
Cr. Erasmus Gordon. 5			
By 7 gross buckles....... @ 1s. 2½d. per pair	60	18	0
———— 18. ————			
George Jaminson, Dr. 6			
4 boxes raisins, wt. 448 lb.......... @ 0s. 8d.			
6 boxes raisins, wt. 827 lb.......... @ 1s. 3d.			
1 box prunes, wt. 604 lb. .... @ 2s. 4d.			
8 bags pepper, wt. 1774 lb.......... @ 3s. 2d.			
———— 20. ————	417	19	5
Cr. Andrew Tomlinson. 1			
By 181 yds. cloth.................. @ 10s. 9¾d.	97	17	0¾
———— 24. ————			
Lord George Mountain, Dr. 3			
137 gallons rum..................... @ 17s. 6d.			
157 gallons rum..................... @ 18s. 0d.			
	261	3	6

		£	s.	d.
_____Toronto, Nov. 26, 1846. _____				
Cr. James Newcastle.	4			
By cash in full		95	5	4
——— 27. ———				
Sir Henry Greatman, Dr.	4			
871 oz. plate........................ @ 5s. 4d.		232	5	4
——— Dec. 6. ———				
Cr. Alexander Penrith,	4			
By cash in full		238	12	10¾
——— 7. ———				
Daniel Roberts, Dr.	7			
171 yards shalloon................ @ 2s. 7d.				
173 yards shalloon..... .... @ 2s. 11d.				
175 yards Yorkshire cloth ...... @ 9s. 6d.				
177 yards fine narrow .... @ 7s. 10d.				
——— 8. ———		199	15	4
Cr. Joshua Housekeeper.	2			
By cash in full.................................		201	4	0¼
——— " ———				
Ambrose Pattersan, Dr.	7			
12 pi. ribbon, meas. 179 yd. .... @ 6½d.				
20 pi. ribbon, meas. 979 yd. .... @ 7¼d.				
18 pi. ribbon, meas. 917 yd. .... @ 7¾d.				
16 pi. ribbon, meas. 821 yd. .... @ 9½d.				
10 pi. ribbon, meas. 171 yd. .... @ 9¾d.				
——— 12. ———		103	9	6¾
Cr. William Johnson.	1			
By cash in full............................		122	0	0
——— " ———				
Cr. Nicholas Cheesemonger.	5			
By cash in part................................		40	0	0

(15.)

	£	s.	d.
_____Toronto, Dec. 16, 1846. _____			
Cr. *Andrew Harrison.* 6			
By cash in full	76	1	6
_____ 20. _____			
Cr. *George Jaminson.* 6			
By cash in part	80	0	0
_____ " _____			
Sir Henry Greatman, Dr. 4			
746 yards linen........................ @ 3s. 4d.			
873 yards muslin....................... @ 6s. 8d.			
_____ 27. _____	415	6	8
Cr. *Lord George Mountain.* 3			
By cash in full	1474	6	2½
_____ " _____			
William Hardware, Dr. 7			
350 razors .... @ 1s. 3¾d.			
420 penknives .... @ 0s. 9½d.			
950 pair scissors .... @ 0s. 2½d.			
230 pair scissors .... @ 0s. 4¾d.			
_____ " _____	54	0	10
Cr. *Joseph Wakefield.* 1			
By cash in full......................	9	0	2¾
_____ 28. _____			
Cr. *Gregory Emerson.* 4			
By cash in full	29	4	2
_____ 29. _____			
Cr. *Miss Louisa Darlington.* 3			
By cash in full	45	0	1

(16.)

_____Toronto, Dec. 29, 1846. _____		£	s.	d.
Cr. George Jaminson.	6			
By cash in full		337	19	5
_____ 30. _____				
Cr. Ambrose Patterson.	7			
By cash in full		103	9	6¾

INDEX TO LEDGER.

1846.		Dr. WILLIAM				£	s.	d.
Jan.	1	To Goods	......	......	......	1	78	16	0
June	19	To Goods	......	......	......	7	122	0	0
						200	16	0
		Dr. ROBERT						
Jan.	1	To Goods	......	......	......	1	242	15	4½
		Dr. JOSEPH						
Jan.	1	To Goods	......	......	......	1	8	2	3½
May	19	To Goods	......	......	......	6	10	17	11¼
Sept.	20	To Goods	......	......	......	10	30	0	0
						49	0	2¾
		Dr. JONATHAN						
Jan.	15	To Goods	......	......	......	1	57	1	9
		Dr. HENRY						
Jan.	24	To Goods	......	......	......	1	19	7	6
		Dr. ANDREW						
Jan.	26	To Goods	......	......	......	2	29	3	6
Oct.	16	To Goods	......	......	......	12	31	13	7
Dec.	31	To Balance	......	......	......		36	19	11¼
						97	17	0¾

1846.		JOHNSON,	Cr.		£	s.	d.
May	4	By Sundries		5	78	16	0
Dec.	12	By Cash		14	122	0	0
					200	16	0

		JENKINSON,	Cr.				
May	27	By Cash		6	242	15	4½

		WAKEFIELD,	Cr.				
Oct.	16	By Cash		12	40	0	0
Dec.	27	By Cash		15	9	0	2¾
					49	0	2¾

		WINTERTON,	Cr.				
Aug.	10	By Cash		9	57	1	9

		GOODFELLOW,	Cr.				
July	26	By Cash		8	19	7	6

		TOMLINSON,	Cr.				
Nov.	20	By Goods		13	97	17	0¾
					97	17	0¾

1846.		Dr.	JOHN				£	s.	d.
Jan.	26	To Goods	....			2	187	1	10
							187	1	10

		Dr.	JOSHUA						
Jan.	28	To Goods	....			2	15	14	6
June	6	To Goods	....			6	65	0	7
July	14	To Goods	....			7	13	10	0
Aug.	24	To Goods	....			9	35	7	11½
Sept.	6	To Goods	....			10	140	9	0
Nov.	7	To Goods	....			13	113	14	9¾
							383	16	10¼

		Dr.	HUMPHREY						
Feb.	1	To Goods	....			2	35	17	6

		Dr.	THOMAS						
Feb.	8	To Goods	....			2	9	18	4

		Dr.	Mrs. ARABELLA						
Feb.	15	To Goods	....			2	19	9	5½
April	20	To Goods	....			4	25	8	0
							44	17	5½

(2.)

1846.		WESTERLY, Esq.	Cr.		£	s.	d.
Aug.	20	By Cash		9	100	0	0
Sept.	12	By Cash		10	87	1	10
					187	1	10
		HOUSEKEEPER.	Cr.				
Oct.	8	By Cash		11	182	12	10
Dec.	8	By Cash		14	201	4	0¼
					383	16	10¼
		ARMSTRONG.	Cr.				
June	11	By Cash		7	35	17	6
		BARROWMAN.	Cr.				
April	10	By Cash		4	9	18	4
		FARMER.	Cr.				
Sept.	6	By Cash		9	44	17	5½
					44	17	5½

1846.		Dr.	LORD				£	s.	d.
Feb.	21	To Goods	......	......	......	2	919	5	6
July	20	To Goods	......	......	......	8	447	6	0
Oct.	2	To Goods	......	......	......	11	47	3	10½
Nov.	12	To Goods	......	......	......	13	49	7	4
	24	To Goods	......	......	......		261	3	6
							1724	6	2½

		Dr.	LADY						
Feb.	21	To Goods	......	......	......	3	9	19	5½
April	29	To Goods	......	......	......	5	33	9	4
Oct.	5	To Goods	......	......	......	11	35	7	0
							78	15	9½

		Dr.	MISS LOUISA						
Feb.	24	To Goods	......	......	......	3	51	18	9
April	16	To Goods	......	......	......	4	13	6	0
May	12	To Goods	......	......	......	6	17	9	4
July	20	To Goods	......	......	......	8	33	6	5½
Sept.	17	To Goods	......	......	......	10	13	19	0
Oct.	20	To Goods	......	......	......	12	15	2	3
							145	1	9½

		Dr.	JOSEPH						
March	4	To Goods	......	......	......	3	4	13	4
Aug.	1	To Goods	......	......	......	8	51	17	7½
							56	10	11½

(3.)

1846.		GEO. MOUNTAIN. Cr.		£	s.	d.
April	29	By a bill on Messrs. Douglas & Co.	5	250	0	0
Dec.	27	By Cash	15	1474	6	2½
				1724	6	2½
		LUSTRING. Cr.				
Nov.	1	By Cash-	12	78	15	9½
				78	15	9½
		DARLINGTON. Cr.				
Nov.	1	By Cash	13	100	0	0
Dec.	29	By Cash	15	45	1	9½
				145	1	9½
		WILMOT. Cr.				
Sept	20	By Cash	10	56	10	11½
				56	10	11½

1846.		Dr. SIR HENRY		£	s.	d.
March	15	To Goods	3	23	12	7
April	27	To Goods	5	76	1	5
Aug.	10	To Goods	9	61	9	8½
Sept.	10	To Goods	10	154	15	0
Oct.	12	To Goods	11	165	18	9
Nov.	27	To Goods	14	232	5	4
Dec.	20	To Goods	15	415	6	8
		To Balance		528	10	6½
				1658	0	0
		Dr. GREGORY				
March	15	To Goods	3	9	4	2
	23	To Goods ..,...	3	20	0	0
				29	4	2
		Dr. JAMES				
March	30	To Goods ,.....	4	22	16	11
Aug.	14	To Goods	9	35	8	3
Sept.	27	To Goods ..,...	10	37	0	2
				95	5	4
		Dr. ALEXANDER				
April	4	To Goods	4	197	5	2
Oct.	3	To Goods .,....	11	41	7	8¾
				238	12	10¾

(4.)

1846.		GREATMAN,	Cr.		£	s.	d.
July	14	By Goods		8	1658	0	0
					1658	0	0
		EMERSON,	Cr.				
Dec.	28	By Cash		15	29	4	2
					29	4	2
		NEWCASTLE,	Cr.				
Nov.	26	By Cash		14	95	5	4
					95	5	4
		PENRITH,	Cr.				
Dec.	6	By Cash		14	238	12	10¼
					238	12	10¼

N

1846.		Dr. WILLIAM			£	s.	d.
April	25	To Goods		4	128	10	6
Aug.	1	To Goods		8	202	2	3
					330	12	9
		Dr. GEORGE					
May	1	To Goods		5	93	2	3½
Oct.	8	To Goods		11	33	5	0
					126	7	3½
		Dr. NICHOLAS					
May	4	To Goods		5	54	11	5
Sept.	16	To Goods		10	92	11	1
					147	2	6
		Dr. MOSES					
May	6	To Goods		6	17	2	4½
		Dr. ERASMUS					
June	11	To Goods		7	67	4	0
					67	4	0

1846.		OGLE, Cr.		£	s.	d.
Nov.	1	By Goods	12	60	12	0
		By Balance		270	0	9
				330	12	9

		TRADER, Cr.				
Oct.	5	By Cash	11	38	10	0
		By Balance		87	17	3½
				126	7	3½

		CHEESEMONGER, Cr.				
Dec.	12	By Cash	14	40	0	0
		By Balance		107	2	6
				147	2	6

		GREENWELL, Cr.				
Nov.	10	By Cash	13	17	2	4½

		GORDON, Cr.				
Nov.	15	By Goods	13	60	18	0
		By Balance		6	6	0
				67	4	0

N 2

1846.		Dr.	ANDREW			£	s.	d.
June	25	To Goods	....	7		76	1	6
		Dr.	JOHN					
July	7	To Goods	....	7		274	14	0
		Dr.	THOMAS					
July	12	To Goods	....	7		343	7	7
Aug.	4	To Goods	....	9		215	19	11
Oct.	10	To Goods	....	11		190	8	6
						749	16	0
		Dr.	GEORGE					
July	26	To Goods	....	8		381	6	8
						381	6	8
		Dr.	JOSEPH					
		To Balance	....			630	0	0
		Dr.	GEORGE					
Nov.	18	To Goods	....	13		417	19	5
						417	19	5

(6.)

1846.		HARRISON,	Cr.		£	s.	d.
Dec.	1(	By Cash		15	7(	1	6
		MONTAGUE,	Cr.				
Oct.	18	By Cash		12	274	14	0
		MERCHANT,	Cr.				
Oct.	18	By Goods		12	155	4	11½
		By Balance			594	11	0½
					749	16	0
		CANDLESTICK,	Cr.				
Oct.	30	By Goods		12	68	4	3¾
		By Balance			313	2	4¼
					381	6	8
		WHOLESALE, Esq.	Cr.				
Nov.	7	By Goods		13	630	0	0
		JAMINSON,	Cr.				
Dec.	20	By Cash		15	80	0	0
	29	By Cash		16	337	19	5
					417	19	5

1846.		Dr.	DANIEL				£	s.	d.
Dec.	7	To Goods	....	14			199	15	4
		Dr.	AMBROSE						
Dec.	8	To Goods	....	14			103	9	6¾
		Dr.	WILLIAM						
Dec.	27	To Goods	....	15			54	0	10
		Dr.	BALANCE,						
		To William Ogle	....	5			270	0	9
		To George Trader	....	—			87	17	3½
		To Nicholas Cheesemonger	......	—			107	2	6
		To Erasmus Gordon	....	—			6	6	0
		To Thomas Merchant	......	6			594	11	0½
		To George Candlestick	......	—			313	2	4¼
		To Daniel Roberts	....	7			199	15	4
		To William Hardware	......	—			54	0	10
							1632	16	1¼
		To present net capital......					437	5	7

(7.)

1846.		ROBERTS,	Cr.		£	s.	d.
		By Balance			199	15	4
		PATTERSON, Cr.					
Dec.	30	By Cash		16	103	9	6¾
		HARDWARE, Cr.					
		By Balanae			54	0	10
		BALANCE, Cr.					
		By Andrew Tomlinson		1	36	19	11¾
		By Sir Henry Greatman		4	528	10	6½
		By Joseph Wholesale, Esq.		6	630	0	0
		By present net capital			437	5	7
					1632	16	1¼

APPENDIX No. II.

MENTAL ARITHMETIC.

Mental Arithmetic is the art of computing by the mind, without the aid of either pencil or pen.

Questions, such as the following, for Mental Addition, Subtraction, Multiplication, and Division, should be frequently *dictated* to the pupils.

ADDITION.

s.	d.		s.	d.		s.	d.		s.	d.		s.	d.		£	s.	d.
1	7	+	2	3	=	3	10		13	4	+	10	9	=	1	4	1
2	5	+	3	1	=	5	6		14	7	+	12	8	=	1	7	3
3	9	+	4	6	=	8	3		15	8	+	13	10	=	1	9	6
4	2	+	3	11	=	8	1		16	1	+	14	6	=	1	10	7
5	3	+	4	5	=	9	8		18	5	+	9	11	=	1	8	4
2	10	+	6	11	=	9	9		19	3	+	18	7	=	1	17	10
6	4	+	7	5	=	13	9		24	6	+	19	8	=	2	4	2
7	6	+	4	8	=	12	2		27	9	+	25	7	=	2	13	4
8	7	+	9	6	=	18	1		38	4	+	41	7	=	3	19	11
12	5	+	7	4	=	19	9		65	2	+	51	11	=	5	17	1

SUBTRACTION.

s.	d.		s.	d.		s.	d.		s.	d.		s.	d.		s.	d.
1	6	—	0	7	=	0	11		20	4	—	13	5	=	6	11
2	7	—	1	3	=	1	4		21	11	—	4	4	=	17	7
3	9	—	1	11	=	1	10		25	3	—	18	6	=	6	9
4	3	—	2	9	=	1	6		27	1	—	9	10	=	17	3
6	2	—	1	3	=	4	11		30	10	—	14	7	=	16	3
8	5	—	5	1	=	3	4		35	2	—	21	4	=	13	10
11	6	—	4	8	=	6	10		41	7	—	28	8	=	12	11
14	1	—	9	6	=	4	7		52	4	—	30	11	=	21	5
18	11	—	3	7	=	15	4		60	0	—	44	7	=	15	5
19	0	—	11	3	=	7	9		75	0	—	58	3	=	16	9

MULTIPLICATION.

s.	d.				£	s.	d.		s.	d.				£	s.	d.
1	4½	×	2	=	0	2	9		4	6	×	14	=	3	3	0
3	7	×	3	=	0	10	9		5	4	×	15	=	4	0	0
4	5½	×	4	=	0	17	10		8	3	×	16	=	6	12	0
2	6¼	×	5	=	0	12	7¼		1	10½	×	20	=	1	17	6
5	7	×	6	=	1	13	6		3	6¼	×	24	=	4	4	6
6	4¾	×	8	=	2	11	2		10	3	×	30	=	15	7	6
7	5¼	×	9	=	3	6	11¼		2	4½	×	32	=	3	16	0
8	9	×	10	=	4	7	6		4	2	×	36	=	7	10	0
10	3½	×	11	=	5	13	2¼		1	6	×	40	=	3	0	0
11	8	×	12	=	7	0	0		6	2	×	42	=	12	19	0

DIVISION.

£	s.	d.				s.	d.		£	s.	d.				s.	d.
0	2	6	÷	2	=	1	3		1	1	0	÷ 14	=		1	6
0	6	9	÷	3	=	2	3		2	9	4	÷ 16	=		3	1
0	5	4	÷	4	=	1	4		8	5	0	÷ 20	=		8	3
0	11	8	÷	5	=	2	4		9	4	0	÷ 24	=		7	8
0	13	6	÷	6	=	2	3		6	12	0	÷ 33	=		4	0
0	15	2	÷	7	=	2	2		4	4	0	÷ 36	=		2	4
1	16	8	÷	8	=	4	7		9	0	0	÷ 40	=		4	6
3	13	6	÷	9	=	8	2		1	6	0	÷ 48	=		0	6½
5	16	8	÷	10	=	11	8		7	10	0	÷ 60	=		2	6
4	8	11	÷	11	=	8	1		32	16	0	÷ 64	=		10	3
3	9	0	÷	12	=	5	9		40	0	0	÷ 80	=		10	0

I. Given the price of 1, to find the price of any number of articles.

RULE. Find the value of the given number of articles, at 1d. each ; multiply this value by the number of pence in the price for the answer.

Note. This rule is very easy when the number of articles does not exceed 300 or 400, and the price any number of pence, not exceeding 3s. If the price be more than 1s. and less than 2s. calculate for the number of pence above 12, to which add as many shillings as there are articles. If the price be more than 2s. and less than 3s. calculate for the number of pence above 2s. to which add twice as many shillings as there are articles, &c.

What is the price of 76 lb. of beef, at 4d. per lb. ?

76d. = 6s. 4d. the value at 1d. per lb.
4

£1 5s. 4d. ans.

			£	s.	d.					£	s.	d.
38 yds. @	3d.	*Ans.*	0	9	6		139 yds. @	6d.	*Ans.*	3	9	6
54 "	4d.	"	0	18	0		146 "	7d.	"	4	5	2
65 "	5d.	"	1	7	1		152 "	8d.	"	5	1	4
79 "	7d.	"	2	6	1		173 "	10d.	"	7	4	2
86 "	8d.	"	2	17	4		184 "	11d.	"	8	8	8
94 "	9d	"	3	10	6		190 "	12d.	"	9	10	0
102 "	10d.	"	4	5	0		210 "	14d.	"	12	5	0
124 "	11d.	"	5	13	8		223 "	15d.	"	13	18	9
135 "	4d.	"	2	5	0		262 "	18d.	"	19	13	0
126 "	5d.	"	2	12	6		300 "	22d.	"	27	10	0

II. To find the value of any number of articles, when the price is an even part of a penny, shilling, or pound.

RULE. Divide the number of articles by the part which the price is of a penny, shilling, or pound ; and the quotient will be the answer in pence, shillings, or pounds respectively.

				£	s.	d.					£	s.	d.
56	@	0¼d.	=	0	1	2	156	@	1s. 4d.	=	10	8	0
56	@	0½d.	=	0	2	4	156	@	1s. 8d.	=	13	0	0
56	@	1d.	=	0	4	8	156	@	2s. 0d.	=	15	12	0
56	@	2d.	=	0	9	4	156	@	2s. 6d.	=	19	10	0
56	@	3d.	=	0	14	0	156	@	3s. 4d.	=	26	0	0
56	@	4d.	=	0	18	8	156	@	4s. 0d.	=	31	4	0
56	@	6d.	=	1	8	0	156	@	5s. 0d.	=	39	0	0
56	@	1s. 0d.	=	2	16	0	156	@	6s. 8d.	=	52	0	0
56	@	1s. 3d.	=	3	10	0	156	@	10s. 0d.	=	78	0	0

III. To find the value of any number of articles, when the price is an even number of shillings.

RULE.—Multiply the given number by half the price ; double the first figure in the product for shillings, and the rest will be pounds.

				£	s.					£	s.
103 yds.	@	2s.	Ans.	10	6	699	yds. @	12s.	Ans.	419	8
224	"	4s.	"	44	16	734	"	14s.	"	513	16
336	"	6s.	"	100	16	878	"	16s.	"	702	8
422	"	8s.	"	168	16	987	"	18s.	"	888	6
574	"	10s.	"	287	0	1032	"	22s.	"	1135	4

IV. To find the value of a dozen articles, having the price of one given.

RULE. For every penny in the price reckon one shilling.

Note 1. For any number of dozens, multiply the price of one dozen by the number of dozens.

Note 2. If the rate per dozen be given, to find the value of one article ; for every shilling in the price per dozen, reckon a penny for the value of one article. For the value of several articles, multiply the price of one by the number.

Note 3. The value of any number of articles, not exceeding 200, may be very expeditiously calculated by the assistance of this rule. Thus : suppose the value of 153 articles be required, at 10d. each ; we have 12 dozen and 9 articles, at 10s. per dozen.

				£	s.	d.
12 doz.	@	10s.	£6	0	0	
9 art.	@	10d.	0	7	6	

£6   7   6 ans.

				s.	d.					£	s.	d.
1 doz. lbs. @	3½d.	=		3	6	2 doz. yds. @	8d.	=	0	16	0
1	"	4¼d.	=	4	3	3	"	10d.	=	1	10	0
1	"	5¾d.	=	5	9	4	"	13d.	=	2	12	0
1	"	6¼d.	=	6	3	5	"	14d.	=	3	10	0
1	"	7d.	=	7	0	6	"	15d.	=	4	10	0
1	"	7½d.	=	7	6	7	"	16d.	=	5	12	0
1	"	11d.	=	11	0	8	"	18d.	=	7	4	0

V. To find the value of 20 articles, or a score.

RULE. For every shilling in the price reckon one pound.

Note 1. If there be 6d. in the price, add 10s.; if 4d. add 6s. 8d ; if 3d. add 5s.; and so on according to the aliquot parts of a shilling. For any number of scores, multiply the price of one score by the number of scores.

Note 2. If the rate per score be given, to find the value of one article ; for every pound in the price per score, reckon a shilling for the value of one article.

			£	s.	d.					£	s.	d.
1 score @	3s. 0d.	—	3	0	0	4 score @	7s. 6d. each	30	0	0
1	"	4s. 6d.	—	4	10	0	5	"	14s. 0d.	"	70	0 0
1	"	5s. 4d.	—	5	6	8	1	"	17s. 4d.	"	17	6 8
1	"	6s. 3d.	—	6	5	0	6	"	16s. 0d.	"	96	0 0
1	"	12s 0d.	—	12	0	0	1	"	2s. 3d.	"	2	5 0
2	"	15s. 0d.	—	30	0	0	3	"	2s. 6d.	"	7	10 0
3	"	11s. 0d.	—	33	0	0	1	"	18s. 0d.	"	18	0 0

VI. To find the value of 100 articles.

RULE. For every shilling in the price reckon £5 ; and for every farthing in the pence, or pence and farthings, reckon 2s. 1d.

			£	s.					£	s.	d.
100 yds. @	5s. 0d.	—	25	0	100 yds. @	10s. 2½d.	—	51	0	10
100	"	6s. 0d.	—	30	0	100	"	11s. 3d.	—	56	5 0
100	"	4s. 6d.	—	22	10	100	"	2s. 3¾d.	—	11	11 3
100	"	7s. 0d.	—	35	0	160	"	12s. 1¼d.	—	60	10 5
100	"	8s. 0d.	—	40	0	200	"	13s. 7½d.	—	136	5 0
100	"	9s. 6d.	—	47	10	300	"	14s. 6d.	—	217	10 0

VII. To find the value of 1 cwt. or 112 articles.

RULE. Multiply 9s. 4d. by the number of pence in the price, for the answer.

Note. If there be farthings in the price; for ¼ add 2s. 4d., for ½ add 4s. 8d., and for ¾ add 7s. For any number of cwts., multiply the price of 1 cwt. by the number of cwts.

			£	s.	d.				£	s.	d.
112 lbs.	@ 4d.	=	1	17	4	112 lbs. @ 10½d.	=	4	18	0
112	" 5d.	=	2	6	8	112 " 11¼d.	=	5	5	0
112	" 7d.	=	3	5	4	2 cwt. @ 6d. per lb.		5	12	0
112	" 7½d.	=	3	10	0	3 " 4½d. "		6	6	0
112	" 8¾d.	=	4	1	8	4 " 5¾d. "		10	14	8
112	" 9½d.	=	4	8	8	5 " 8d. "		18	13	4

VIII.   To find the value of 120, 240, 480, or 900 articles.

RULE. For 120 reckon a pound for every 2d. in the price ; for 1d. reckon ten shillings, for a ½d. five shillings, and for a ¼d. reckon 2s. 6d.

For 240 reckon a pound for every penny in the price ; for a ½d. reckon ten shillings, and for a ¼d. five shillings.

For 480 reckon a pound for every ½d. in the price, and for ¼d. ten shillings.

For 960 reckon a pound for every farthing in the price.

		£	s.	d.			£	s.	d.
120 @ 0s. 7d. each	=	3	10	0	480 @ 1s. 3d. each	=	30	0	0
120 @ 0s. 9½d.	"	4	15	0	480 @ 1s. 7½d.	"	39	0	0
120 @ 0s. 11¾d.	"	5	17	6	480 @ 2s. 3¾d.	"	55	10	0
240 @ 1s 4d.	"	16	0	0	960 @ 0s. 9d.	"	36	0	0
240 @ 2s. 3½d.	"	27	10	0	960 @ 1s. 7¼d.	"	77	0	0
240 @ 4s. 9¾d.	"	57	15	0	960 @ 2s. 9¾d.	"	135	0	0

IX.   To find the interest of any sum of money for a year, at 5 per cent.

RULE.   Divide the given sum by 20, for the answer in pounds.

Note 1. For any number of years, multiply the interest of one year by the number of years.

Note 2. If at the rate of 6 per cent. find the interest by the rule as above, to which add ⅕ of itself ; if at 5½ per cent add 1/10. If the rate of interest be at 4 per cent. deduct ⅕ of itself; if at 4½ deduct 1/10.

				£	s.	d.
£145	@ 5 per cent. for 1 year	=		£7	5	0
482	@ 5 ...	...	=	24	2	0
734	@ 5 ...	...	=	36	14	0
836	@ 5 ...	...	=	41	16	0
982	@ 5 ...	...	=	49	2	0
1500	@ 5 ...	...	=	75	0	0
2000	@ 5 ...	...	= 100	0	0
2540	@ 5 per cent. for 2 years	=	254	0	0
3483	@ 5 ... for 3 years	=	522	9	0
4696	@ 5 ... for 4 years	=	939	4	0

X. An easy method of finding interest for months, at 6 per cent.

RULE. Multiply the principal by the number of months,—dot off the unit figure,—this gives the answer in shillings and tenths of a shilling.

What is the interest of £50, for 7 months, at 6 per cent.?

£50
7
‾‾‾‾
35.0=£1 15s. ans.

What is the interest of £80, for 9 months, at 6 per cent.?

£80
9
‾‾‾‾
72 0=£3 12s. ans.

What is the interest of £125, for 5 months, at 6 per cent.?

£125
5
‾‾‾‾
62.5=£3 2s. 6d. ans.

What is the interest of £137, for 8 months, at 6 per cent.?

£137
8
‾‾‾‾
109.6=£5 9s. 7⅕d ans.

Examples may be given at pleasure.

Note 1. The value of any number of articles may sometimes be very easily found by dividing the price into two or more parts. Thus; if the value of 63 lb of sugar, at 7d. per lb., be required, we have 63 sixpences=31s. 6d., and 63d.=5s. 3d.; consequently the ans. is 36s. 9d.

Note 2. When neither the number nor the price is large, the value may sometimes be readily found by multiplying the number by the price and dividing the number by 12.

Note 3. The required values may be sometimes found by calculating the given numbers at more or less than the given prices; and then adding or subtracting such sums as from the nature of the questions will produce the answers. Thus; 50 at 1½d =100d.—12½d. =7s. 3½d. — 72 at 13s. 4d. = £72—£24=£48; and 96 at 22s. 6d.=£96+12=£108.

APPENDIX No. III.

FEDERAL MONEY.

In the United States, or federal money, dollar is the money unit; all other denominations being valued according to their situation from the dollar's place: hence, *simple* and *compound* addition, subtraction, multiplication, and division of federal money, are the same.

Addition.	Subtraction.	Multiplication.	Division.
13456	163087	9573	4)306336
40143	86503	8	———
22985	———	———	76584
———	76584	76584	
76584			

The above operations are called *simple*, but in federal money they are also *compound*, and the result may be read,—

7 eagles, 6 dollars, 5 dimes, 8 cents, 4 mills ; or

76 dollars, 58·4 cents ; for the mill being an imaginary piece, is properly a decimal of a cent.

But besides the federal money, there are in every State another kind, consisting of pounds, shillings and pence currency.

Formerly the pound was of the same sterling value in all the colonies as in Great Britain, and a Spanish dollar worth 4s. 6d.; but the legislatures of the different colonies emitted bills of credit, which afterwards depreciated in their value, in some States more, in others less, &c.

Thus a dollar is reckoned in

New England, Virginia, Kentucky and Tennessee... 6s.
New York and North Carolina .... 8s.
New Jersey, Pennsylvania, Delaware and Maryland 7s. 6d.
South Carolina and Georgia .... 4s. 8d.
Canada, Nova Scotia, &c. .... 5s.

Hence, to reduce the currency of the several States to federal money ; say, As the current value of the dollar in any State : is to 1 dollar : : so is the given currency : to its equivalent federal money. And *vice versa.*

Reduce £73 New England and Virginia currency to federal money. As 6s. : 1 dol. : : £73 : $243 33½ cents.

Reduce $629 into New York or North Carolina currency. As $1 : 8s. : : $629 : £251 12s. ans.

Reduce £125 Canada or Nova Scotia currency to federal money. As 5s. : $1 : : £125 : $500 ans.

Reduce $741 into Canada and Halifax currency. As $1 : 5s. : : $741 : £185 5s ans.

Table of York Currency corresponding to Canadian or Halifax Currency.

C. C.	Y. C.	C. C.	Y. C.	C. C.	Y. C.	C. C.	Y. C.	C. C.	Y. C.
0s. 0½d	0s. 0⅘d	1s. 0½d	1s. 8d	2s. 0½d	3s. 3¼d	3s. 0½d	4s.10⅖d	4s. 0½d	6s. 5
0 1	0 1⅗	1 1	1 8¼	2 1	3 4	3 1	4 11⅖	4 1	6 6⅖
0 1½	0 2⅘	1 1½	1 9⅗	2 1½	3 4⅘	3 1½	5 0	4 1½	6 7⅕
0 2	0 3⅕	1 2	1 10⅖	2 2	3 5⅗	3 2	5 0⅘	4 2	6 8
0 2½	0 4	1 2½	1 11⅕	2 2½	3 6⅖	3 2½	5 1⅗	4 2½	6 8¼
0 3	0 4⅘	1 3	2 0	2 3	3 7⅕	3 3	5 2⅖	4 3	6 9⅗
0 3½	0 5⅗	1 3½	2 0⅘	2 3½	3 8	3 3½	5 3⅗	4 3½	6 10⅖
0 4	0 6⅖	1 4	2 1⅗	2 4	3 8⅘	3 4	5 4	4 4	6 11⅕
0 4½	0 7⅕	1 4½	2 2⅖	2 4½	3 9⅗	3 4½	5 4⅘	4 4½	7 0
0 5	0 8	1 5	2 3⅕	2 5	3 10⅖	3 5	5 5⅗	4 5	7 0⅘
0 5½	0 8⅘	1 5½	2 4	2 5½	3 11⅕	3 5½	5 6⅖	4 5½	7 1⅗
0 6	0 9⅗	1 6	2 4⅘	2 6	4 0	3 6	5 7⅕	4 6	7 2⅖
0 6½	0 10⅖	1 6½	2 5⅗	2 6½	4 0⅘	3 6½	5 8	4 6½	7 3⅕
0 7	0 11⅕	1 7	2 6⅖	2 7	4 1⅗	3 7	5 8¼	4 7	7 4
0 7½	1 0	1 7½	2 7⅕	2 7½	4 2⅖	3 7½	5 9⅗	4 7½	7 4⅘
0 8	1 0⅘	1 8	2 8	2 8	4 3⅕	3 8	5 10⅖	4 8	7 5⅗
0 8½	1 1⅗	1 8½	2 8⅘	2 8½	4 4	3 8½	5 11⅕	4 8½	7 6⅖
0 9	1 2⅖	1 9	2 9⅗	2 9	4 4⅘	3 9	6 0	4 9	7 7⅕
0 9½	1 3⅕	1 9½	2 10⅖	2 9½	4 5⅗	3 9½	6 0⅘	4 9½	7 8
0 10	1 4	1 10	2 11⅕	2 10	4 6⅖	3 10	6 1⅗	4 10	7 8⅘
0 10½	1 4⅘	1 10½	3 0	2 10½	4 7⅕	3 10½	6 2⅖	4 10½	7 9⅗
0 11	1 5⅗	1 11	3 0⅘	2 11	4 8	3 11	6 3⅕	4 11	7 10⅖
0 11½	1 6⅖	1 11½	3 1⅗	2 11½	4 8⅘	3 11½	6 4	4 11½	7 11⅕
1 0	1 7⅕	2 0	3 2⅖	3 0	4 9⅗	4 0	6 4⅘	5 0	8 0

PRACTICAL QUESTIONS IN FEDERAL MONEY.

1. What is the sum of 46 dollars 9 cents, 100 dollars 7 cents, 99 dollars 75 cents, 451 dollars 99 cents, and 1 dollar 1 cent?
Ans. 698 dollars 91 cents.

2. A farmer paid $75 41 ct. for a horse, $54 4 ct. for a yoke of oxen, $21 for a cow, $7 41 ct. for three sheep, $1 50 ct. each for two pigs, and $64 for a waggon: how much has he paid in all?
Ans. $224 86 cts.

3. From $315 63 cts. subtract $146 8 ct.
Ans. $169 55 ct.

4. Subtract $48 9 ct. from $70 5 ct. *Ans.* $21 96 ct.

5. What cost 35 lb. cheese, at 8 cents per lb.?
Ans. $2 80 cents.

6. What is the value of 29 pair of shoes, at 1 dollar 51 cents per pair?
Ans. $43 79 cents.

7. What cost 131 yards Irish linen, at 38 cents per yard?
Ans. $49 78 cents.

8. What cost 140 reams paper, at 2 dollars 35 cents per ream?
Ans. $329.

9. What cost 94 bushels of oats, at 33 cents per bushel?
Ans. $31 2 cents.

10. What is the value of 75 yards satin, at 3 dollars 75 cents per yard?
Ans. $281 25 cents.

11. What cost 367 acres of land, at 14 dollars 67 cents per acre?
Ans. $5383 89 cents.

12. What will 857 barrels pork come to, at 18 dollars and 93 cents per barrel?
Ans. $16223 1 cent.

13. Bought 25 lbs. of coffee for 5 dollars: what is that per lb.?
Ans. 20 cents.

14. If 131 yards of Irish linen cost 49 dollars 78 cents: what is that per yard?
Ans. 38 cents.

15. If a cwt. of sugar cost 8 dollars 96 cents: how much is that per lb.?
Ans. 8 cents.

16. If a reckoning of 25 dollars 50 cents be paid equally by 15 persons: what do they pay a piece? *Ans.* $1 70 cents.

17. If a man's wages are 237 dollars 25 cents a year: how much is that per day?
Ans. 65 cents.

18. The salary of the President of the United States is $25,000 a year: what is that per day? *Ans.* $68 49 $\frac{23}{72}$ cts.

19. What is the interest of $73 65 cents, for a year, at 6 per cent.?
Ans. $4 41 $\frac{9}{10}$ cents.

20. Required the interest of $85 45 cents, for a year, at 7 per cent.? *Ans.* $5 98$\frac{3}{20}$ cents.

21. What is the interest of $789, for 2 years, at 6 per cent.? *Ans.* $94 68 cents.

22. What is the interest of $37 50 cents, for 4 years, at 6 per cent. per annum? *Ans.* $9.

23. If an agent sell goods to the amount of 5000 dollars: what will his commission come to at 65 cents per cent.? *Ans.* $32 50 cents.

24. What is the insurance of an East India ship and cargo, valued at 123,425 dollars, at 15$\frac{1}{2}$ per cent.? *Ans.* $19,130 87$\frac{1}{2}$ cents.

25. Bought rum at $1.25 per gallon, which, not proving so good as I expected, I am content to lose 18 per cent. by it: how must I sell it per gallon? *Ans.* 1.02$\frac{1}{2}$.

26. A farmer sells a quantity of corn at $1 per bushel, and gains 20 per cent. ; very soon after he sold some of the same, to the amount of $37.50, and gained 50 per cent.: how many bushels were there in the last parcel, and at what rate did he sell it per bushel?

120 : $1 : : 150 : $1.25. $1.25)$37.50(30 bush. *Ans.*

27. A. and B. venturing equal sums of money, clear by trade $154; by agreement, A. was to have 8 per cent. because he spent his time in the trade, and B. was only to have 5: what was A. allowed for his trouble?

13 : $154 : : 3 : 35.53\frac{11}{13}$. *Ans.*

Calculations of all kinds in federal money being so simple and easy, are particularly well adapted to mental arithmetic: e. g. 100 articles at any number of cents a piece, come to the same number of dollars.

$$
\begin{array}{lll}
100 \text{ lb. at 7 cents per lb.} & = & 7 \text{ dollars.} \\
100 \text{ lb. at 16 cents per lb.} & = & 16 \text{ dollars.} \\
100 \text{ yds. at 25 cents per yd.} & = & 25 \text{ dollars.} \\
100 \text{ yds. at 38 cents per yd.} & = & 38 \text{ dollars.}
\end{array}
$$

of course the number 50 comes to $\frac{1}{2}$ the number of dollars that there are cents in the price,—25 to $\frac{1}{4}$ the number,—20 to $\frac{1}{5}$, &c.

Rules for reducing the currencies of the several United States, also Canada, Nova Scotia, and Stering, each into the par of all the others. See the given currency in the left hand column, and then cast your eye to the right hand, till you come under the required currency, and you will have the rule.

	N. Eng. Virg Ken. & Ten.	N. Jer. Pen. Del. & Mary.	New York & N. Carolina.	S. Carolina & Georgia.	Canada and Nova Scotia.	Sterling.
N. Eng. Virg. Ken. and Ten.		Add ¼.	Add ⅓.	Mult. by 7, & div. by 9.	Mult. by 5, & div. by 6.	Deduct ¼.
N. Jer. Penn. Del. and Mary.	Deduct ⅕.		Add $\frac{1}{13}$.	Mult. by 28, & div. by 45.	Deduct ⅓.	Mult. by 3, & div. by 5.
New York and N. Carolina.	Deduct ¼.	Deduct $\frac{1}{13}$.		Mult. by 7, & div. by 12.	Mult. by 5, & div. by 8.	Mult. by 9, & div. by 16.
S. Carolina and Georgia.	Mult. by 9, & div. by 7.	Mult. by 45, & div. by 28.	Mult. by 12, & div. by 7.		Mult. by 15, & div. by 14.	Deduct $\frac{1}{28}$.
Canada and Nova Scotia.	Add ⅕.	Add ½.	Mult. by 8, & div. by 5.	Deduct $\frac{1}{15}$.		Deduct $\frac{1}{16}$.
Sterling.	Add ⅕.	Mult. by 5, & div. by 3.	Mult. by 16, & div. by 9.	Deduct $\frac{1}{27}$.	Add ⅛.	

FEDERAL MONEY.

Exercises on the preceding table, to reduce the different currencies of the several States into each other, at par.

1. Reduce £84 10s. 8d. New Hampshire, &c., currency, into New Jersey currency.   *Ans.* £105 13s. 4d.

2. Reduce £120 8s. 3d. Connecticut currency, into New York currency.   *Ans.* £160 11s.

3. Reduce £120 10s. Massachusetts currency, into South Carolina and Georgia currency.   *Ans.* £93 14s. 5½d.

4. Reduce £410 18s. 11d. Rhode Island currency, into Canada and Nova Scotia currency.   *Ans.* £342 9s. 1⅛d.

5. Reduce £524 8s. 4d. Virginia, &c., currency, into Sterling money.   *Ans.* £393 6s. 3d.

6. Reduce £125 10s. 4d. New York, &c., currency, into South Carolina currency.   *Ans.* £73 4s. 4⅜d.

7. Reduce £214 9s. 2d. New Jersey, &c., currency, into New Hampshire, Massachusetts, &c., currency.

   Ans. £171 11s. 4d.

8. Reduce £100 New Jersey, &c., currency, into New York and North Carolina currency.   *Ans.* £106 13s. 4d.

9. Reduce £100 Delaware and Maryland currency, into sterling money.   *Ans.* £60.

10. Reduce £116 10s. New York currency, into Connecticut currency.   *Ans.* £87 7s. 6d.

11. Reduce £112 7s. 3d. South Carolina and Georgia currency, into Connecticut, &c., currency.   *Ans.* £144 9s. 3⁴d.

12. Reduce £100 Canada and Nova Scotia currency, into Connecticut currency.   *Ans.* £120.

13. Reduce £116 14s. 9d. sterling money, into Connecticut currency.   *Ans.* £155 13s.

14. Reduce £104 10s. Canada and Nova Scotia currency, into New York currency.   *Ans.* £167 4s.

15. Reduce £100 Halifax currency, into New Jersey, &c., currency.   *Ans.* £150.

VALUE OF COINS IN CANADIAN CURRENCY.

	£	s.	d.
British Sovereign, or Pound sterling...	1	4	4
British Crown	0	6	1
British Half-Crown	0	3	0½
British Shilling	0	1	2⅖

o 2

	£	s.	d.
British Sixpence	0	0	7$\frac{3}{16}$
United States Eagle.......................	2	10	0
United States and Mexican Dollar......	0	5	1
Half Dollars of the above	0	2	6$\frac{1}{2}$
Quarter do. do.	0	1	3
Eighth do. do.	0	0	7$\frac{1}{2}$
Sixpence do. do.	0	0	3$\frac{1}{2}$
French Five Franc Piece	0	4	8

A TABLE showing the interest of any sum of money, from £1 to £1000, for any number of months, at 6 per cent.

SUM.	1 month.			2 months.			3 months.			6 months.			1 year.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
£1	0	0	1	0	0	2$\frac{1}{4}$	0	0	3$\frac{1}{2}$	0	0	7	0	1	2$\frac{1}{4}$
2	0	0	2$\frac{1}{4}$	0	0	4$\frac{3}{4}$	0	0	7	0	1	2$\frac{1}{4}$	0	2	4$\frac{3}{4}$
3	0	0	3$\frac{1}{2}$	0	0	7	0	0	10$\frac{3}{4}$	0	1	9$\frac{1}{2}$	0	3	7
4	0	0	4$\frac{3}{4}$	0	0	9$\frac{1}{2}$	0	1	2$\frac{1}{4}$	0	2	4$\frac{3}{4}$	0	4	9$\frac{1}{2}$
5	0	0	6	0	1	0	0	1	6	0	3	0	0	6	0
6	0	0	7	0	1	2$\frac{1}{4}$	0	1	9$\frac{1}{2}$	0	3	7	0	7	2$\frac{1}{4}$
7	0	0	8$\frac{1}{4}$	0	1	4$\frac{3}{4}$	0	2	1	0	4	2$\frac{1}{4}$	0	8	4$\frac{3}{4}$
8	0	0	9$\frac{1}{2}$	0	1	7	0	2	4$\frac{3}{4}$	0	4	9$\frac{1}{2}$	0	9	7
9	0	0	10$\frac{3}{4}$	0	1	9$\frac{1}{2}$	0	2	8$\frac{1}{4}$	0	5	4$\frac{3}{4}$	0	10	9$\frac{1}{2}$
10	0	1	0	0	2	0	0	3	0	0	6	0	0	12	0
20	0	2	0	0	4	0	0	6	0	0	12	0	1	4	0
30	0	3	0	0	6	0	0	9	0	0	18	0	1	16	0
40	0	4	0	0	8	0	0	12	0	1	4	0	2	8	0
50	0	5	0	0	10	0	0	15	0	1	10	0	3	0	0
60	0	6	0	0	12	0	0	18	0	1	16	0	3	12	0
70	0	7	0	0	14	0	1	1	0	2	2	0	4	4	0
80	0	8	0	0	16	0	1	4	0	2	8	0	4	16	0
90	0	9	0	0	18	0	1	7	0	2	14	0	5	8	0
100	0	10	0	1	0	0	1	10	0	3	0	0	6	0	0
200	1	0	0	2	0	0	3	0	0	6	0	0	12	0	0
300	1	10	0	3	0	0	4	10	0	9	0	0	18	0	0
400	2	0	0	4	0	0	6	0	0	12	0	0	24	0	0
500	2	10	0	5	0	0	7	10	0	15	0	0	30	0	0
1000	5	0	0	10	0	0	15	0	0	30	0	0	60	0	0

TABLE OF EXCHANGE between England and Canada.

The rate of Exchange is always above par in favor of Britain. Par is £90 sterling for £100 Canada currency.

Value of £1 currency in sterling money.			Per cent. above Par.	Value of £1 sterling in Canada currency.		
	s.	d.			s.	d.
£$\frac{90}{101}$ or 17	9¾ $\frac{45}{101}$		1 per cent.	1·1222 or 22	5¼·3	
£$\frac{15}{17}$ or 17	7¾ $\frac{1}{17}$		2 per cent.	1·1333 or 22	8	
£$\frac{60}{103}$ or 17	5½ $\frac{36}{103}$		3 per cent.	1·1444 or 22	10½·6	
£$\frac{45}{52}$ or 17	3½ $\frac{10}{13}$		4 per cent.	1·1555 or 23	1¼·3	
£$\frac{6}{7}$ or 17	1½ $\frac{5}{7}$		5 per cent.	1·1666 or 23	4	
£$\frac{180}{211}$ or 17	0 $\frac{202}{211}$		5½ per cent.	1·1722 or 23	5¼·3	
£$\frac{45}{55}$ or 16	11¾ $\frac{5}{55}$		6 per cent.	1·1777 or 23	6½·6	
£$\frac{130}{151}$ or 16	10¾ $\frac{19}{7}$		6½ per cent.	1·1833 or 23	8	
£$\frac{90}{107}$ or 16	9¾ $\frac{51}{107}$		7 per cent.	1·1888 or 23	9¼·3	
£$\frac{36}{43}$ or 16	8¾ $\frac{31}{43}$		7½ per cent.	1·1944 or 23	10½·6	
£$\frac{5}{6}$ or 16	8		8 per cent.	1·2000 or 24	0	
£$\frac{360}{433}$ or 16	7½ $\frac{66}{413}$		8¼ per cent.	1·2027 or 24	0½·6	
£$\frac{180}{217}$ or 16	7 $\frac{63}{217}$		8½ per cent.	1·2055 or 24	1¼·3	
£$\frac{20}{29}$ or 16	6½ $\frac{14}{29}$		8¾ per cent.	1·2083 or 24	2	
£$\frac{90}{109}$ or 16	6 $\frac{72}{109}$		9 per cent.	1·2111 or 24	2½·6	
£$\frac{360}{437}$ or 16	5½ $\frac{370}{437}$		9¼ per cent.	1·2138 or 24	3¼·3	
£$\frac{60}{73}$ or 16	5¼ $\frac{3}{73}$		9½ per cent.	1·2166 or 24	4	
£$\frac{360}{439}$ or 16	4¾ $\frac{107}{439}$		9¾ per cent.	1·2194 or 24	4½·6	
£$\frac{9}{11}$ or 16	4¼ $\frac{5}{11}$		10 per cent.	1·2222 or 24	5¼·3	
£$\frac{120}{147}$ or 16	3¾ $\frac{33}{49}$		10¼ per cent.	1·2250 or 24	6	
£$\frac{180}{221}$ or 16	3¼ $\frac{199}{221}$		10½ per cent.	1·2277 or 24	6½·6	
£$\frac{360}{443}$ or 16	3 $\frac{60}{443}$		10¾ per cent.	1·2305 or 24	7¼·3	
£$\frac{90}{111}$ or 16	2½ $\frac{14}{37}$		11 per cent.	1·2333 or 24	8	
£$\frac{75}{89}$ or 16	2 $\frac{56}{89}$		11¼ per cent.	1·2361 or 24	8½·6	
£$\frac{180}{223}$ or 16	1½ $\frac{108}{223}$		11½ per cent.	1·2388 or 24	9¼·3	
£$\frac{120}{149}$ or 16	1¼ $\frac{23}{49}$		11¾ per cent.	1·2416 or 24	10	
£$\frac{45}{56}$ or 16	0¾ $\frac{3}{7}$		12 per cent.	1·2444 or 24	10½·6	
£$\frac{360}{449}$ or 16	0¼ $\frac{319}{449}$		12¼ per cent.	1·2472 or 24	11¼·3	
£$\frac{4}{5}$ or 16	0		12½ per cent.	1·2500 or 25	0	
£$\frac{360}{451}$ or 15	11½ $\frac{134}{451}$		12¾ per cent.	1·2527 or 25	0½·6	
£$\frac{90}{113}$ or 15	11 $\frac{69}{113}$		·13 per cent.	1·2555 or 25	1¼·3	
£$\frac{120}{151}$ or 15	10½ $\frac{132}{131}$		13¼ per cent.	1·2583 or 25	2	
£$\frac{180}{227}$ or 15	10¼ $\frac{53}{227}$		13½ per cent.	1·2611 or 25	2½·6	
£$\frac{72}{91}$ or 15	9¾ $\frac{51}{91}$		13¾ per cent.	1·2638 or 25	3¼·3	
£$\frac{15}{19}$ or 15	9¼ $\frac{14}{19}$		14 per cent.	1·2666 or 25	4	

All decimals end in repeaters.

USES OF THE FOREGOING TABLE.

I. To find how much sterling money in any sum of currency:
—multiply the value of £1 sterling, at the given rate, by the
given sum.

How much sterling money in £60 C. currency, at 9 per cent.
above par?

$$\frac{90}{109} \times \frac{60}{1} = \frac{5400}{109} \quad 109)5400$$

Sterling £49 10s. 9¾d. $\frac{69}{100}$ ans.

Or thus, £0 16 6 $\frac{72}{108}$
                    6
                  ─────────
             4 19 0$\frac{3105}{4100}$
                    10
                  ─────────
Or 109 : 90 :: 60 : £49 10s. 9¾d. $\frac{69}{100}$ £49 10 9¾$\frac{69}{100}$

1. How much sterling in £120 currency, at 10¼ per cent.
above par?   *Ans.* £97 19s. 2d. $\frac{120}{147}$
2. Received £180 currency from Liverpool: what is the
value in sterling money, at 8¾ above par?
                                  Ans. £148 19s. 3½d. $\frac{26}{29}$
3. A merchant in London owes me £350 currency: how
much sterling will pay the bill of exchange, at 10½ per cent.
above par?   *Ans.* £285 1s. 4¾d. $\frac{35}{221}$
4. I have to remit to a friend in Glasgow £245 currency:
how much sterling will he receive, at 8¼ per cent.?
                                  Ans. £203 13s. 10¾d. $\frac{149}{433}$

II. To find how much C. currency in any sum of sterling
money:—multiply the value of £1 currency, at the given rate,
by the given sum.

How much C. currency in £80 sterling, at 9¼ per cent.
above par?

1·2138
    80
─────────
97·1111=£97 2s. 2½d. ·6 cur.

Or thus, £1 4 3¼ ·3
                   8
                 ─────────
             9 14 2½ ·6
                   10
                 ─────────
Or 90 : 109¼ :: 80 : £97 2s. 2½d· ·6   £97 2 2½ ·6 ans.

5. How much C. currency in £140 sterling, exchange at 9¾
per cent. above par?   *Ans.* £170 14s. 5¼d. ·3
6. At 12 per cent. above par, how much currency will pay a
bill of exchange for £320 15s. sterling?
                                  Ans. £399 3s. 1¼d. ·3

APPENDIX No. IV.

FORMS OF RECEIPTS, BILLS, &c.

A Receipt is a written acknowledgment of having received a sum of money.

In general, on settling an account, nothing more is necessary than writing below it,

> 1846, Feb. 1. Settled the above, or
> By Cash in full.
>
> 1846, Mar. 10. By Cash in part, or
> Received in part.
>
> 1846, April 17. By promissory note, at 1 month,
> in full, or in part.
>
> By acceptance at 3 months, do.
> (with signature.)

Galt, 12th March, 1846. — Received from John Black, Esq., twenty pounds ten shillings, in part payment of his account.
£20 10s.   ROBERT WILSON.

Dundas, 4th December, 1846.—Received from Mr. James Stewart, thirty pounds eight shillings, in full of his account to this date.   WILLIAM DOUGLAS.

Toronto, 14th January, 1846.—Received of James Greatman, Esq., seventy-five pounds, in part of a bill of one hundred pounds.
£75.   ADAM SOMERVILLE.

Hamilton, Received, 17th April, 1846, of Mr. Robert Walton, one hundred pounds, for self and company.
£100.   JAMES ALDERMAN.

Received from Mr. Henry Mortimer, junior, fifty pounds, which I promise to repay on demand.
Galt, 1st January, 1846.   DAVID MORGAN.

Quebec, 15th September, 1846.—Received from Mr. George Turnbull, six pounds, for half a year's interest of two hundred pounds, lent on bond to the trustees of Albion Chapel, due the 1st instant.
£6.   TIMOTHY CAREFUL.

Toronto, 4th June, 1846.—Received from Mr. James Scotland, twenty-two pounds ten shillings, being half a year's rent of the house and garden, rented by him from me, due at Whit Sunday last.

£22 10s.   ALEXANDER LAIRD.

Montreal, 19th April, 1846.—Received of Messrs. Jameson and Christie, assignees of the effects of Thomas Mercer, a bankrupt, thirty pounds ; being my proportion of the said bankrupt's effects, and is after the rate of ten shillings per pound, for my debt of sixty pounds, proved under the said commission.

£30.   DAVID LINENDRAPER.

BILLS.

1. A *Bill* is a document providing for the payment of a certain sum of money, at a specified time.

2. A *Promissory Note* is a bill expressed in the form of a promise from one person to pay to another.

3. A *Draft* is a bill expressed in the form of an order, signed by one person, and addressed to another ; requiring the latter to pay the specified sum to the former, or to some third person.

4. The person who signs the draft is called the *Drawer ;* the person to whom it is addressed is called the *Drawee ;* and the person to whom the payment is to be made is called the *Payee.*

5. The Drawee binds himself to pay the bill by writing his name within it ; after which he is called the *Accepter.*

6. The bill is said to be *drawn by* the Drawer ; *drawn upon* the Drawee or Accepter ; and *drawn in favour of* the Payee.

7. A person who transfers his right of receiving payment of a bill to another, or who becomes security for its payment, writes his name on the back of it : he is then said to *endorse* the bill, and he is called the *Endorser.*

8. When the Endorser, besides writing his own name, specifies the person to whom he transfers his right, the bill is said to be *specially endorsed :* when he writes his own name only, the endorsement is called *blank* or *general.*

9. The *term* of a bill is the space of time at the end of which it is to be paid.

10. The term of a bill is sometimes a specified time *after date,* that is, after drawing ; sometimes it is a specified time *after sight,* that is, after acceptance.

11. Bills to be paid in the same country in which they are drawn, are called *inland* bills: and bills to be paid in a different country from that in which they are drawn, are called *foreign* bills.

12. The Drawer of a foreign bill generally makes out several copies of it, which together are called a *set of Exchange*, and remits them by different ships or posts, to guard against loss or miscarriage. In this case, acceptance and payment of each of the sets are required only on condition that the others have not been accepted or paid ; and a clause to this effect is always inserted in such bills : therefore, when one bill of the set is accepted, the duplicates are of no further use.

13. When a bill is not paid for at the proper time, the holder of it puts it into the hands of a Notary, who demands payment from the Drawee ; in default of which, he signs a document called a *Protest*, which facilitates the recovery of the amount of the bill. In certain cases, a bill may be protested for non-acceptance.

14. A bill which a person has to receive the amount, is called, to that person, a *Bill Receivable;* and one of which a person has to pay the amount, is called to him a *Bill Payable.*

PROMISSORY NOTES.

£450 18s.   Dundas, 9th April, 1846.

Six months after date, we promise to pay to James Cunningham, or order, the sum of four hundred and fifty pounds, eighteen shillings, Halifax currency, value received.

John Wilson & Co.

£310 2s. 6d.   Kingston, 10th November, 1846.

Four months after date, I promise to pay to Messrs. Robertson & Co., at the Commercial Bank here, the sum of three hundred and ten pounds two shillings and sixpence, Halifax currency, value received.

James Thomson.

£100.   Galt, March 16, 1846.

Three months after date, we jointly and severally promise to pay to James Clerk, merchant, Montreal, at the Gore Bank, Hamilton, the sum of one hundred pounds, Halifax currency, value received.

James Blair,
Charles Scott.

£200.   Toronto, 15th January, 1846.

I promise to pay to Mr. Isaac Trotter, two hundred pounds, in manner following, viz., fifty pounds three months after date, fifty pounds at six months, and the remaining hundred pounds at twelve months, for value received.

Peter Justice.

INLAND BILLS.

£150.   Hamilton, **January 3, 1846.**

    Three months after date, pay to my order, one hundred
and fifty pounds, Halifax currency, for value received.

To Mr. Wm. Nesbit,   }   *John Johnstone.*
    Merchant, Brantford. }   accepted,   *William Nesbit.*

£57 16s.   Montreal, 6th March, 1846.

    Sixty days after date, pay to Mr. George Renton, or order,
fifty-seven pounds sixteen shillings, for value received.

To Adam Kerr, Esq }   *Robert Smith.*
    Kingston.   }   accepted, *Adam Kerr*, payable at
                              Commercial Bank, here.

FOREIGN BILLS OF EXCHANGE.

1250 guil.   London, 3rd October, 1846.

    At usance and half usance, pay this our first of exchange,
second and third not paid, to E. Van Buren, or order, twelve
hundred and fifty guilders, value received, and place the same
to our account, as per advice from

To E. Bushnell, }   *Roe, Davis, & Jones.*
    Amsterdam.   }   *E. Bushnell.*

8700 livres at 29d.   Paris, 21st May, 1846.

    At forty days after date, pay to John Bosanquet, or order,
eight thousand seven hundred livres, exchange 29d. per ecu,
value received, as per advice, from

To James Goldsworthy, Esq. }   *Philip Le Roux,*
        London.   }   *James Goldsworthy.*

£450 ster.   New York, 1st January, 1846.

    Sixty-five days after sight, pay this my first of exchange,
(second and third not paid,) to the order of John Thompson,
James Brown & Co., four hundred and fifty pounds sterling,
value received, as advised by

                                    Jonathan Wallace.
Messrs. Smithson & Sons, }   seen February 24, 1846.
        Liverpool.   }   *Smithson & Sons.*

APPENDIX No. V.

MENSURATION.

A few more useful things in Measuring.

A figure of 3 sides is called a TRIANGLE : when all the 3 sides are equal in length, it is called an *equilateral* triangle ; when 2 of its sides are equal, it is called an *isosceles* triangle ; when all its sides are unequal, a *scalene* triangle. Triangles are also denominated *right angled* (as that in page 142) and *oblique angled* triangles.

To find the area of a triangle, of any form or size.

RULE I. Multiply the base by the perpendicular height, and half the product will be the content or area.

RULE II. When the 3 sides only are given. From ½ the sum of the 3 sides subtract each side separately ; multiply the half sum and the three remainders continually together ; and the square root of the product will be the area.

1. How many square yards are in a triangle, whose base is 40, and perpendicular height 30 feet ?   *Ans.* 66⅔ sq. yds.

2. Required the content of a triangle, whose base is 18 feet 4 inches, and height 11 feet 10 inches.

Ans. 108 ft. 5 in. 8 pts.

3. What is the area of a triangular field, whose base is 6.25 chains, and height 5.20 chains ?   *Ans.* 1 a. 2 r. 20 per.

4. How many square yards are in a triangle, whose three sides are 13, 14, 15, feet ?   *Ans.* 9¼ sq. yds.

5. Required the area of a triangular field, whose base is 40 chains, and its perpendicular height 15 chains.   *Ans.* 30 a.

6. How many acres are in a triangular field, whose 3 sides are 380, 420, 760 yards ?   *Ans.* 9 a. 3 r. 6.8 per.

A figure of 4 sides is called a quadrangle or quadrilateral. When all its sides are equal, and all its angles right angles, it is called a *square :* when all its angles are right ones, but its length greater than its breadth, it is called a *parallelogram :* when all its sides are equal, but its angles oblique, it is called a *rhombus :* an oblique angled parallelogram is called a *rhomboid.*

To find the area of all these four-sided figures : Multiply the length by the breadth.

7. How many acres are in a square field, whose side is 18.25 chains ?   *Ans.* 33 a. 1 r. 9 per.

8. What is the area of a parallelogram, whose length is 12.25 chains, and breadth 8.50 chains?

Ans. 10 a. 1 r. 26 per.

9. How many square yards of painting in a rhomboid, whose length is 12 ft. 3 in. and breadth 5 ft. 4 in. ?

Ans. 7 yd. 2 ft. 4 in.

10. What is the area of a rhombus, whose length is 6.20 chains, and perpendicular height 5.45 ?

Ans. 3 a. 1 r. 20.64 per.

When a quadrilateral is irregular in its sides and angles, it is called a *trapezium.* A line joining 2 opposite angles of a trapezium is called a *diagonal.*

To find the area of a trapezium : Multiply the diagonal by the sum of the perpendiculars drawn to it from the opposite angles, and half the product will be the area.

11. Required the area of a trapezium, the diagonal being 42 yards, and the perpendiculars falling upon it from the opposite angles 18 and 16 yards.   *Ans.* 714 yards.

12. What is the area of a trapezium, whose diagonal is 17.56 chains, and the perpendiculars 8.82 and 7.73 chains ?

Ans. 14 a. 2 r. 5 per.

To find the area of an irregular figure of 5, 6, 7, &c., sides. Draw diagonals dividing the figure into trapeziums and triangles. Then find the areas of all these separately, and add them together for the area or content of the whole figure.

Examples may be given at pleasure.

When all the sides and all the angles of a 5, 6, 7, &c., sided figure are equal, it is called a regular polygon.

To find the area of a regular polygon : Multiply the square of one of its sides by the number opposite its name in the following table.

No. of Sides.	Names.	Multipliers.
5	Pentagon	1.7204774
6	Hexagon	2.5980762
7	Heptagon	3.6339126
8	Octagon	4.8284272
9	Nonagon	6.1818240
10	Decagon	7.6942088
11	Undecagon	9.3656411
12	Dodecagon	11.1961524

13. What is the area of a Hexagon whose side is 5 inches?
Ans. 64.951905 in.

14. What is the area of an Octagon whose side is 60 yards?
Ans. 3 a. 2 r. 14 per. 19 yds.

A CIRCLE is a figure bounded by a curve line, called the *circumference*, which is every where equidistant from a point within, called the *centre*. The *radius* of a circle is a straight line drawn from the centre to the circumference. The *diameter* is a line drawn through the centre, to the circumference on both sides.

To find the Diameter and Circumference of a Circle, the one from the other. Multiply the diameter by 3.1416 gives the circumference. Divide the circumference by 3.1416 gives the diameter.

15. What is the circumference of a circle whose diameter is 20 yards? Ans. 62.832 yards.

16. What is the diameter of a circle whose circumference is 78.54 feet? Ans. 25 feet.

To find the area of a circle. Multiply the square of the diameter by .7854;—or multiply the square of the circumference by .07958. Hence, the area being given, to find the diameter or circumference, is only to reverse the process.

17. Required the area of a circular orchard whose circumference is 56.5 rods or poles. Ans. 1 a. 2 r. 14 per.

18. What is the area of a circular pond whose diameter is 31 yards? Ans. 754.7694 sq. yds.

19. I want a circular garden that shall occupy just half an acre: how many feet long will the stone wall be that encloses it? Ans. 523.15 feet.

20. In the midst of a meadow well stored with grass,
I took just an acre to tether my ass;
How long must the cord be, that, feeding all round,
He mayn't graze less or more than an acre of ground?
Ans. 39.25+ yards.

To find the area of the surface of a sphere or globe. Multiply the square of the diameter by 3.1416.

21. Required the superficial area of a globe whose diameter is 12 inches. Ans. 452.3904 sq. in.

22. How many square miles in the surface of the earth, supposing it a sphere of 7912 miles diameter?
Ans. 196,663,355.7504 sq. m.

To find the solidity of a sphere or globe. **Multiply the cube** of the diameter by .5236.

23. How many cubic or solid inches are in a globe 12 inches diameter?   *Ans.* 904.7808 c in.

24. How many cubic or solid miles does the earth contain, its mean diameter being 7912 miles?

              Ans. 259,333,411,782.8608 c. m.

To find the convex surface of a cylinder. Multiply the circumference of its base by the altitude.

25. What is the convex surface of a cylinder, the diameter of whose base is 20 and altitude 50 inches?

                        Ans. 21.8+ sq. feet.

To find the area of an ellipse or oval. Multiply the product of the axes by .7854.

26. What is the area of an elliptic ceiling, the axes of which are 33 feet 5 inches, and 20 feet 3 inches?

              Ans. 59 yds. 0 ft. 67 in.

To find the content of a common cask. Find the mean diameter, by adding to the head diameter ⅔ of the difference between the bung and head diameters ; or if the staves are not much curved, by adding ⅗. This reduces the cask to a cylinder. Then multiply the square of the mean diameter by .7854, and the product by the length, for the solid contents in inches, which reduce to gallons.

27. How many imperial gallons in a cask, whose bung diameter is 36 inches, head diameter 30 inches, and length 50 inches?   *Ans.* 163.72 gallons.

THE END.

ERRATA TO BE CORRECTED WITH A PEN.

Page 29, Question 10,   *for* £15 5s. *read* £15 15s.
 32,   "   12,   "   8s. 9¼d.   "   8s. 9½d.
 38,   "   9 ans.   "   636   "   686.
 109, 8th line from bottom, "   is   "   has.
 113,   "   7   "   219.75   "   .21975.
 114, Case III.   "   larger   "   lower.
 152,   "   4 ans. " £3657 4s. 1⅕d. "   £2657 4s. 1⅛d.
 140,   "   23   "   68.3   "   68.3̇
Page 134, Questions 3–4–5–6 are erroneous.
3rd Question should be 102 : 90 : : £500 : £441 3s. 6¼d.$\frac{7}{17}$ ans.
4th Question should be 90 : 102 : : £441 3s. 6¼d.$\frac{7}{17}$: £500 ans
5th Question should be 99 : 90 : : £1000 : £909$\frac{1}{11}$ ans.
6th Question should be 90 : 99 : : £909$\frac{1}{11}$: £1000 ans.

Notices of the Canadian School Atlas, intended as an accompaniment to Gouinlock's Geography.

"CANADIAN SCHOOL ATLAS.—The above is the title of a book published for the use of Canadian Schools. The work contains ten beautifully executed Maps—the whole series coloured in excellent style. The work is one of great comparative magnitude, and reflects the highest honour upon the enterprise of the publishers, to whom the country now owes a School Atlas, peculiarly its own. The book has, we hear, received the approval of the best teachers of the city; and the extremely low rate at which it is disposed of, warrants the hope that it may speedily come into general use in the whole of the British Colonies."—*Literary Garland.*

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